Place a one cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers or sailors destined to proceed overseas. NO WRAPPER. NO ADDRESS.
A. S. Burleson, Postmaster General.

SCIENTIFIC AMERICAN

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

GENERAL LIBRARY
MAR 21 1919
UNIV. OF MICH.

THE CURIOUS "UMBRELLA BAT" OF THE CONGO TAKING HIS DAY-TIME SLUMBERS [See page 286]

Vol. CXX. No. 12
March 22, 1919

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 10 Cents
$5.00 a Year

PULL!
The long, strong pull that is in every Bethlehem Motor Truck is one of the big Bethlehem reasons for Bethlehem Dominance.
Built to Carry the Owner's Confidence
BETHLEHEM
Internal Gear Drive
MOTOR TRUCKS
DEPENDABLE DELIVERY
CHASSIS PRICES
1½-Ton — $1965
2½-Ton — $2365
3½-Ton — $3465
The Motor Truck bought today without Electric Starting and Lighting will be out of date tomorrow
BETHLEHEM MOTORS CORP'N
ALLENTOWN PA.

You, Mr. Property Owner, are responsible for America's appalling fire waste

You owe it to yourself and to the community to preserve intact that portion of the country's wealth entrusted to your care.

Will you do your part? The Hartford Fire Insurance Company is able and willing to help you.

A well-organized and sound insurance company has two functions:

1. **To co-operate with its policy-holders so that they may avoid loss.**
2. **To indemnify them for unavoidable losses.**

The "Hartford" gives both forms of service. It will co-operate by giving you expert advice on the following and other topics having to do with the avoidance or minimizing of loss. It will tell you

1. **How to build safely.**
2. **How to guard against the dangers inherent to your business.**
3. **How to arrange your plant so as to prevent serious interruption by a small fire.**
4. **How to establish a system of care and maintenance which will make for safety.**
5. **How to select and install the most suitable apparatus for promptly extinguishing fires if they occur.**

These suggestions will be supplemented by visits from engineers and inspectors who will help to maintain proper conditions. But the responsibility rests with you.

AS TO INDEMNITY. The "Hartford" offers the guarantee of its reputation for commercial honor built up during 109 years of faithful service. This guarantee is backed by assets of over $40,000,000.

It solicits an opportunity to co-operate with property owners who realize their responsibility and are willing to enter into a mutually helpful relationship.

Any agent or broker can get you a policy in the

THE HARTFORD FIRE INSURANCE CO. HARTFORD CONN

HARTFORD FIRE INSURANCE CO.

HARTFORD ACCIDENT AND INDEMNITY COMPANY HARTFORD CONN

The Two Hartfords—the Hartford Fire Insurance Co. and the Hartford Accident & Indemnity Co.—write practically every form of insurance except life.

HARTFORD FIRE INSURANCE CO.
HARTFORD ACCIDENT AND INDEMNITY CO.
Hartford, Conn.

Announcing
JOHNS-MANVILLE
Asbestone

(Approved by Underwriters' Laboratories)

JOHNS MANVILLE SERVICE COVERS THE CONTINENT

Through—

Asbestos

and its allied products

JOHNS-MANVILLE
Serves in
Conservation

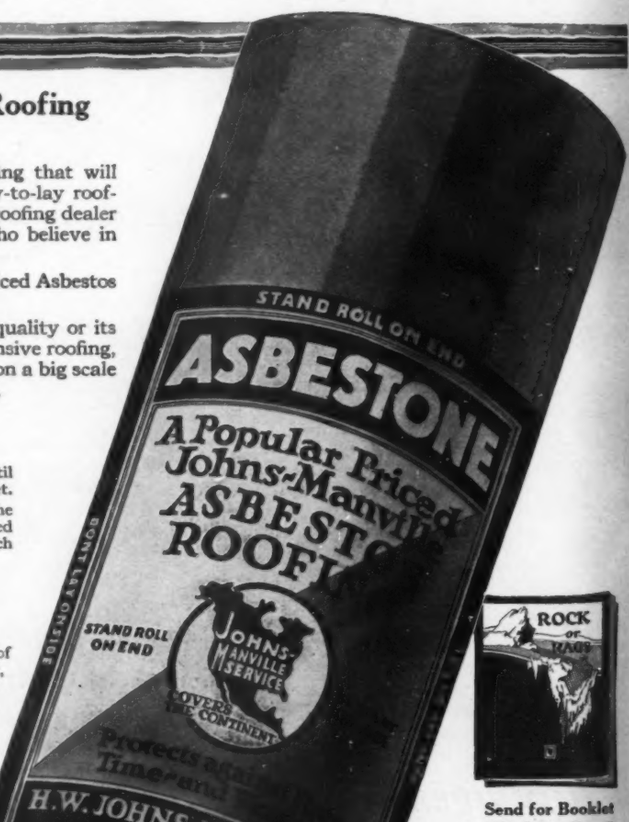
Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

A Johns-Manville Asbestos Roofing at a Popular Price

"GIVE us a Johns-Manville Asbestos Roofing that will be within the price range of other ready-to-lay roofings." This has been the demand of the roofing dealer and the wish of thousands of roofing users, who believe in the superiority of an Asbestos Roofing.

Here is the answer to the demand, a popular-priced Asbestos Roofing in ready-to-lay form—Asbestone.

It is not a cheap roofing in the sense that its quality or its composition have been slighted. It is an inexpensive roofing, only because its manufacture has been planned on a big scale and its cost therefore is down to the minimum.



Send for Booklet "Rock or Rags"

What Asbestone Is

Like all other Johns-Manville Asbestos roofings, ASBESTONE is a mineral fabric, composed of Asbestos fibre, cemented together with natural asphalts. Gray mottled Asbestic finish on one side, smooth black surface on the other. May be laid either side to the weather. Rolls contain all necessary fasteners for laying. Can be applied by anyone.

Asbestone defies time and repels fire. The varying degrees of heat and cold leave it unchanged, because being *all-mineral*, there is nothing in it to disintegrate, dry out or rot. It never requires painting, and it will give years of service without the need or cost of repairs.

Ask Your Dealer to Show You Asbestone

Examine this roofing at your dealer's store. Let him tell you why it is the cheapest per year roofing.

By all means defer your roofing purchase until you know all about Asbestone. Write for booklet.

To the Trade: Our sales policy provides for the marketing of this material through recognized distributors and dealers. Address nearest branch for particulars.

The Same Institution Behind All Johns-Manville Roofing—Vouches for Asbestone

Whether you buy Asbestone, or any one of the other Johns-Manville Asbestos Roofings, you can register your roof with us, which puts it on our records as Johns-Manville Roofing in Service. We then obligate ourselves to see that this roofing bears out all claims we make for it. It is our responsibility to see that it gives you the service promised.

Other Johns-Manville Roofings

Johns-Manville Asbestos Roofings are made in great variety for all roofing needs. Johns-Manville Asbestos and Colorblende Shingles for homes. Johns-Manville Brooks and Flextone Ready Asbestos Roofing for sloping roofs or large permanent buildings. Johns-Manville Built-Up Roofing for all flat surfaces, and Johns-Manville Corrugated Asbestos Roofings for skeleton frame buildings.

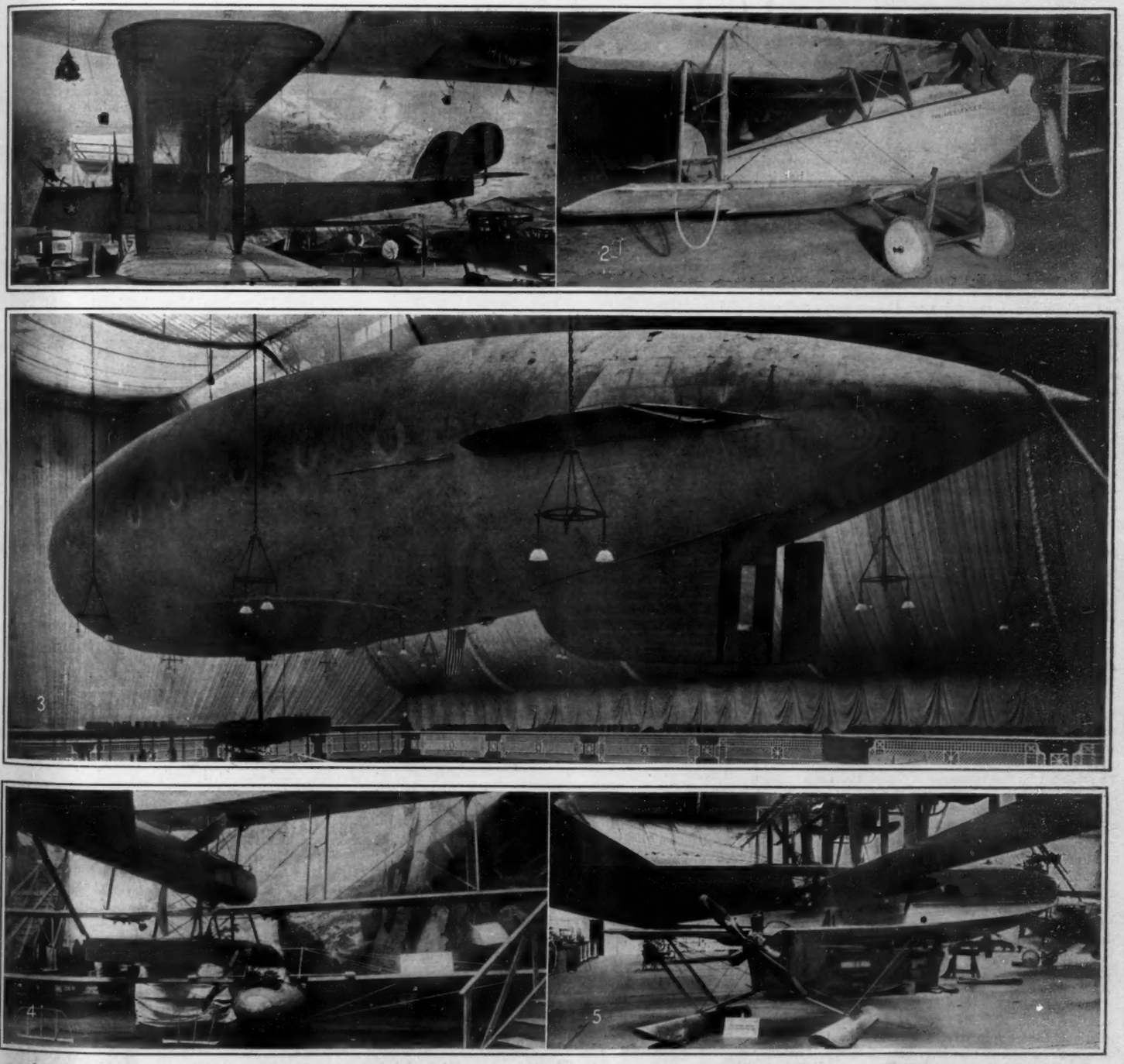
H. W. JOHNS-MANVILLE CO.
New York City
10 Factories—Branches in 63 Large Cities

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXX.] NUMBER 12] NEW YORK, MARCH 22, 1919 [10 CENTS A COPY $5.00 A YEAR



In the order shown, the exhibits are: 1.—The Glenn Martin twin-engine bomber. 2.—The "Messenger" sport plane. 3.—The naval "Blimp" or small dirigible. 4.—The Gallaudet seaplane, with "Chummy Flyabout" below it. 5.—Huge naval plane, with Loening "Baby" seaplane below it.

Some of the leading exhibits at the recent Aeronautical Exposition.—(See page 290)

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, March 22, 1919
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Copyright 1919 by Scientific American Publishing Co.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

To Solve the Battle-Cruiser Problem

THE announcement that the Secretary of the Navy has ordered a suspension of work on the six 35-knot battle-cruisers which had been authorized but not built, brings to our minds the battle-cruiser controversy which raged so fiercely inside and outside the Navy Department some two years ago. The three-year program of 1916 called for these ships. They were to make good a serious gap in our naval defenses, for at that time we had no battle-cruisers whatsoever. The British had completed the "Repulse" and "Renown," 800-foot ships, of 110,000 horse-power and 32-knot speed, mounting six 15-inch guns, and our naval constructors produced plans for a very remarkable ship, far outstripping the "Renown" in all points of comparison. The new battle-cruisers were to be 875 feet long; they were to make 35 knots with 180,000 horse-power, and were to mount ten, 14-inch guns. The ships were to be equipped with the electric drive.

The plans called for the placing of 12 out of the 24 boilers above the protective deck, presumably because, with such a huge horse-power as 180,000, there was not room for them below deck. As our readers will remember, the SCIENTIFIC AMERICAN entered an earnest protest against these ships on the grounds that, because of their exposed position, these boilers would be put out of action when the enemy got the range. Our objection to the ships was a military one, for we knew that no captain would wish to carry his ship into action with such a heavy handicap upon it. Our protest was largely instrumental in bringing about a reconsideration of the designs, and the latest plans for these ships called for placing the whole of the boiler plant below the protective deck. Although the delay due to these changes seemed at the time regretable, it now appears that it was most fortunate; for the lessons taught by the war point to the abandonment of both the lightly-armored battle-cruiser and the super-armored battle-ship in favor of a compromise type in which the distribution of displacement between gun, armor, motive power, ammunition, and berthing accommodation is to be arranged on the principle of "give and take." The new type of ship has only one element which will not be interfered with, and that is the provision of comfortable living quarters for officers and men; for the personnel is far and away the most important element in the makeup of a well-found fighting ship.

The British have already adopted this compromise type, and the first of its class, the "Hood," is nearing completion. This ship may be called a high-speed battleship or a heavily armored battle-cruiser, just as you please. She will carry eight 15-inch rifles, with battleship armor of not less than 12 inches thickness, and will have a speed of 30 to 31 knots. Her displacement will be 41,000 tons.

There is a division of opinion among our naval officers and, as usual, the advocates of a broader, less conventional, more progressive attitude are to be found among those officers who have been abroad and actively engaged in the present war, while the more conservative attitude is to be found in the General Board and among those officers who have been under the immediate influence of the Secretary. Thus, in favor of a compromise ship are Admiral Sims, Admiral Benson, and Admiral Mayo, all of whom spent much of their time abroad during the war; on the other hand, many of the members of the General Board would like to see the distinction between slow, heavily armored battleship and fast, lightly armored battle-cruiser maintained.

Why have the English abandoned the battle-cruiser type and why are they willing to drop a few guns from the battlship in exchange for a few knots more speed and heavier armor? The answer is not far to seek. It is found in the Battle of Jutland, where three of the British battle-cruisers were sunk by gunfire, and where a few knots more speed would have enabled the British battleships to plant themselves squarely across the line of retreat of the German fleet to its own ports.

Now that the threat of aggression has been removed from the high seas and the call for haste in naval construction is no longer heard, there is every reason why we should proceed with great caution in the determination of new designs for our Navy. The history of naval construction among all nations is largely a history of precipitate action leading to the construction of types of ships that were ascertained to be of doubtful value even before they left the stocks; and, therefore, we count it a matter of good fortune that honest and helpful criticism served to prevent the construction of our battle-cruisers as they were originally designed, and will result in giving us a new type which embodies in itself the combined strategical and tactical lessons of the recent war.

The Scientific Insurgent

WHEN accepted scientific doctrine is allowed to stand too long unquestioned, it usually degenerates into dogma. A case in point is the attitude of the medical world through the centuries when bleeding was the one remedy for all ills, and it was forbidden even to suggest that a sufferer from fever be allowed to drink. Current doctrine is accepted because it must be true because it is accepted; and anyone who attempts to burst the bonds of this vicious circle is automatically and eternally damned.

One drawback to such insulated orthodoxy is that the theories and doctrines which today's orthodoxy supports are not necessarily true; and by the categorical refusal to discuss them, insulated orthodoxy delays their replacement by a better creed. So long as it was forbidden to question the Ptolemaic system, so long was recognition of the Copernican system impossible. So long as physicians were horrified at the mere idea of omitting to bleed, and held that one who gave a fever patient a drink was convicted of malpractice on the mere showing of fact, so long was progress in medicine inhibited.

But the fact that orthodoxy's refusal to debate its beliefs leads to persistence in error is not the only indictment against it. Every scientist must have his beliefs with reference to the fundamentals of his science; but when he refuses to debate these beliefs, to listen to argument of any sort, to admit that there is anything to be considered save the weight of authority, or that the questioner can be anything other than the rankest heretic—this is not a healthy state of mind. Modern enlightenment calls down shame upon the head of him who cannot afford to meet objectors on their own ground. If accepted doctrine cannot point to facts which contradict an alternative hypothesis, or which fail to be explained by that hypothesis, or which are poorly explained thereby—then accepted doctrine, if it be promulgated in the modern scientific spirit, will admit the alternative hypothesis to tentative standing, and institute a vigorous search for new facts which substantiate or disprove one of the conflicting theories. And when accepted doctrine fails or fears to do this, it admits weakness.

Accordingly we have no sympathy for the point of view which condemns a new system, almost before it has been advanced, on the ground that it *is* new. Of course there are limitations here, as everywhere else: we will not debate seriously with the man who insists that the sun is cold because as he climbs a mountain and gets nearer to it, the temperature falls; we have been known to reason with individual circle-squarers, but with the tribe we have little patience; and in general, with the advocate of a new idea who willfully blinds himself to the merits of the old we have as little patience as with the advocate of the old who refuses to look at the new. But when a new hypothesis of any nature is advanced in a rational manner, with due recognition of what it must do to replace the old, and with an intelligent and especially with an interesting attempt to do this, then we hold that it claims attention. A certain amount of mild heterodoxy is far preferable to unreasoned orthodoxy; and it is beneath the dignity of no one to read and ruminate upon the ideas advanced by the scientific insurgent.

An interesting case in point will be found in the current number of the SCIENTIFIC AMERICAN SUPPLEMENT. A New Zealand amateur scientist of some note has built up with pains the suggestion that, after all, perhaps it is not fair to treat the moon as a satellite of the earth, which goes around the sun only because the earth about which its orbit lies goes itself around the sun. He brings forward the supposition that the earth and the moon are rather to be regarded as twin planets, each with its individual orbit around the sun, and each with its perturbations in that orbit caused by the presence of the other. He unfolds this heliocentric theory at considerable length, in a most interesting manner, and with enough plausibility to keep constantly on the alert any reader who may bring to it the viewpoint that he will not admit it under any consideration. On every ground, no one who is unwilling to admit prejudice need feel that he cannot afford to read this discussion.

British and German Warships Compared

WITH amazing but commendable frankness Admiral Jellicoe has made known the fact that though the German fleet at the Battle of Jutland was inferior in numbers, it was superior in quality. No other conclusion is possible. Apparently it was only in gunpower and numbers that the British had the advantage, and even this was offset by the fact that the German shells carried a delay-action fuse, which caused them to burst inside the ship. The British fuses were too sensitive—the bursts occurring on the armor or while passing through it. In view of the fact that we perfected an armor-piercing, delay-action shell over 18 years ago, this revelation by Jellicoe will be received with amazement.

Of equal, if not, greater moment is the announcement that the German ships were greatly superior in resistance to the torpedo. This was due to their greater beam, which permitted the construction of wider anti-torpedo spaces between the skin of the ship and the interior, armored, longitudinal bulkheads. The blame for this lies at the door of the British people, who would not vote the appropriations for building the larger drydocks necessary to accommodate the wider ships. Battleships were popular; drydocks were not. This underwater protection saved many a German ship at Jutland and elsewhere. The "Goeben" was found to have been torpedoed five times; but her inner bulkheads held and the ship was still good for 15 knots. The later British ships, designed during the war, carry the "blister" or bulge—which serves the purpose admirably, as the monitors proved on many occasions.

A greater area of the German ships was armored than of the British, and the average thickness of this armor was greater. Moreover, the deck protection was not only heavier, but it extended throughout the ship, the British being content to armor only the magazines and other vitals. Thus we learn that nine of the earliest British dreadnoughts, including several of the battle-cruisers, were without protection above the main deck, whereas all German ships were protected to the upper deck.

In weighing this criticism we must bear in mind that Jellicoe has been severely criticized for not closing in to finish the German fleet. His statement therefore is a defense of his policy. It "passes the buck" to the Naval Constructor, who, doubtless, will be heard in his own defense. Until that is forthcoming it would be well to reserve judgment. Nor must we forget that the German Naval critic, Captain Persius, recently wrote in the *Tageblatt*. "Had the weather been clear, the destruction of the whole German navy would have resulted."

Was Jellicoe overcautious? That will ever remain a matter of opinion. The enemy had some eighty destroyers to his forty. A night attack might have cost him one-half his fleet, and with the British command of the sea lost, the whole Allied cause would have gone by the board. The British would have been cut off from France, and we could not have sent a man to Europe.

Engineering

Electrification of Railroads in Italy.—During the war Italy experienced such a shortage of coal that it had to turn to water power, which is found in profusion in that country. Italy was one of the first countries to use electricity on its railroads and there has been a great deal of activity in that direction of late. At present, projects are under foot to electrify 1,250 miles of railroad.

Manila Rope Made Brittle by Freezing.—A correspondent in the *Engineering News Record* calls attention to the necessity of thawing out ropes before they are used. Fall rope and that used in standing rigging do not absorb much moisture. They soon dry out and are comparatively free from dirt, so that no special precautions are required in the case of such ropes, but general utility ropes are apt to contain as much as 30 to 40 per cent of moisture. This does the rope no harm, but on freezing the fibers become brittle and the rope weak. It should, therefore, be thawed out before it is subjected to any heavy strains. Dirt also is apt to reduce the working life of a rope, as the grit cuts into the fibers and frays them rapidly.

Concrete Flume in Hawaii.—Owing to the scarcity of steel in the Hawaiian Islands during the war, substitutes for steel had to be used as far as possible. On one of the sugar plantations a concrete flume was used to carry water across a gulch. The flume was formed as an inverted siphon, consisting of a rectangular box resting on concrete columns. It is about 6½ feet wide and nearly five feet deep and is supported about 35 feet above the bottom of the gulch. A bell-and-spigot expansion joint connects the horizontal portion of the flume with one of the inclined stacks, the space between being filled with asphaltic cement. This joint has operated satisfactorily without any signs of leakage for a number of months.

Psychology on a Construction Job.—The superintendent of a construction job, says the *Engineering News Record*, was annoyed to find that a crew of carpenters did not attend to their work properly, while a derrick was periodically swinging its load over their heads. The men invariably stopped work to watch the loads pass by. A canvas awning was stretched over the carpenters' benches. This was obviously no protection at all against a falling object; nevertheless, it served its purpose, because the carpenters were unable to see the work of the derrick, and although they knew that the loads were passing over them, they did not stop and stand ready to dodge if the derrick should let go. This device resulted in the saving of 10 per cent of carpenters' lost time.

Using the Files Economically.—Quoting from *Der Schweizerische Eisenwarenhandel* the *Practical Engineer* states that a file when new, if viewed under a strong magnifying glass, will be found to consist of fine points or teeth so far as the cutting surface is concerned, and if passed over a piece of hard steel or other hard resistant metal it will be found that the majority of these teeth have splintered off, leaving a very indifferent set of cutting points. For this reason it is best always to use files first on brass and copper alloys, as this saves the teeth from breaking away while the heat engendered by the working friction somewhat anneals them, and makes them fit to follow on with wrought iron and mild steel, harder steel and cast iron taking the last place, and after these the files want re-cutting if they be thick enough.

Shearing Strength of Reinforced Concrete Beams.—The Emergency Fleet Corporation, faced with the problem of constructing ships of concrete, found it necessary to make tests of concrete beams in order to determine the proper design of construction for these vessels. As a result of the tests made, it was found that, in the case of deep beams the standards heretofore accepted had been too low and that much larger shearing stresses could be used with safety. The investigation is not complete as yet, but the studies so far made will have an important bearing upon the use of concrete in other structures such as buildings and bridges. In some cases concrete has not been used because of limitations in shearing strength imposed by the standards that have prevailed up to the present time, but with the standards revised there will be an opportunity for a wider use of concrete.

Science

Whale Fat for Making Margarin and Lard.—The last annual report of the U. S. Commissioner of Fisheries states that in 1914 Denmark used 20,000 barrels of hardened whale fat in the margarin industry. Freparations are under way in Norway for utilizing this material in the same way. The product is said to keep and taste well. Whale fat is even better suited for making lard. In this connection it is stated that experiments are in progress in the United States with fish oils, to determine the possibility of making them suitable for use in the human dietary.

Medical Men in the House of Commons.—An interesting innovation in the British Parliament is the formation of a House of Commons Medical Committee, consisting of M. P.'s who hold a medical or surgical degree or are specially interested in medical or scientific matters. The committee, of which Sir Watson Cheyne is chairman, is to exchange views on all proposed legislation relating to medical matters or kindred subjects, especially with a view to avoiding the expression of conflicting medical or scientific views in parliamentary debate. The committee will also serve as a connecting link between the House of Commons and medical and other scientific bodies. Commenting on this innovation, *Nature* expresses the hope that eventually other branches of science may be directly represented in Parliament.

The Hot Blast of Volcanoes.—Writing in the *Monthly Weather Review*, Mr. George N. Cole sets forth detailed arguments to prove that the hot blast which swept over the city of St. Pierre during the eruption of Mont Pelée, as well as similar blasts in connection with the eruption of Vesuvius that destroyed Pompeii and Herculaneum, the eruption of Taal, Sakurajima, etc., derived its heat from the sudden compression of the air surrounding the volcano, and not from conditions in the volcano itself. In other words, it was not, according to this hypothesis, an outpouring of hot crater gases that caused the destruction, but the dynamic heating of the air attending the propagation of the explosion wave. Mr. Cole cites a number of interesting observations at St. Pierre after the Martinique disaster that seem to support this idea.

The International Institute of Agriculture has for many years been carrying out, within its province, undertakings strikingly analogous to those contemplated for the proposed League of Nations. During the war it continued to be a center for worldwide agricultural information, statistical and otherwise. At a meeting of the permanent committee of the institute on November 30th last, resolutions were passed expressing ardent wishes for the realization of the League of Nations, and offering the services of the institute in connection with the work of supervising food production and distribution, etc., for the world at large. The resolutions point out that "during the war the Allied nations have confederated their activities in the handling of agricultural distribution, of raw materials, transportation, and finance," and that "it may be that the League of Nations to be formed will provide for the continuation of such federated activities." If so, the League will find in the Institute of Agriculture an agency admirably organized for carrying on this important work.

Marine Algæ of the Pacific Coast.—The economic importance of seaweed is a subject that has of late attracted unprecedented interest throughout the world. The last annual report of the U. S. Bureau of Fisheries states that, through the coöperation of a specialist from the University of California, the Bureau has been making a large collection of the marine algæ of the Pacific coast from Gray's Harbor, Wash., to Sitka, Alaska. Many new forms have been discovered and the range of species previously known has been extended. The collection is to be deposited in the U. S. National Museum. "Interest in the marine algæ," says the report, "arises from the intimate relations existing between them and the fishes and shellfishes; from the significance of marine plants as ultimate sources of organic material in the sea, and thus as an indirect source of food for fishes; and from the fact that the algæ are resources useful in some cases for human food and in others as the basic material for potash, iodine, gelatin, and other products useful in the arts and industries." The marine algæ are still to be classed among the neglected resources of the United States.

Industrial Efficiency

How Denmark Uses Industrial Films.—The Danish association Dansk Arbeide (Danish Labor), which was founded about ten years ago and whose motto is "Buy Danish manufactures when they are as good and as cheap as imported goods," has done a great work for Danish industry. The association has now taken into its publicity service the showing of industrial films produced by the recently formed Danish industrial film organization, which takes films in the Danish factories with a view to showing them, accompanied by suitable titles, throughout the country and afterwards lending the films out to the country teachers' film association to be used in the schools.

The Disabled Soldier Problem.—"Have you a job for a man who is trained for it?" is the question the Federal Board for Vocational Education is now asking the employers of the United States. "The Government will do the training. Will you provide the job?" It is the intention of the Government to assist in placing each disabled soldier and sailor, regardless of his handicap, in suitable civil employment. The men are not to be dealt with from the viewpoint of giving them special "soft jobs"; on the contrary, the employers of America are requested to consider their employment as a business proposition. An effort will be made to place each man in the occupation in which he is most interested, provided it is neither waning nor overcrowded. How this is to be accomplished is discussed in a monograph, "What the Employers of America Can Do for the Disabled Soldier and Sailor." Copies may be obtained from the Federal Bureau of Vocational Education, Washington, D. C.

Alcohol from Lava and Peat.—The present shortage of alcohol, especially for motor boats, gives special importance to the new method for extracting alcohol from peat and lava. Though lava was used for this purpose in the middle of the last century when the potato crop failed, it has since then been neglected. Peat is found on thousands of hectares and a depth of seven to eight meters (22.96 to 26.25 feet), continues *Svensk Handelstidning*. From 100 kilos (220 pounds) of dried-peat substance about six liters (1.58 gallons) of 100 per cent alcohol can be obtained. This is about the same yield as potatoes. The method of extracting alcohol from peat is about the same as by sulfite. The peat is boiled under pressure with sulfuric acid, by which a sugar solution is obtained and some residue products. After the acid has been neutralized with lime, the sugar solution is made into alcohol, the peat residue being collected and made into briquettes for fuel. The experiments made with regard to this method of extracting alcohol have been successful, and the Swedish Government has agreed to the building of a factory on the basis that the shareholders of the company should have the right to purchase and use the alcohol for their motor boats, trucks, and private automobiles irrespective of government prohibitions and maximum prices.

Sending Trade Literature to Canada.—The attention of American manufacturers is directed to the frequent omission on their part of the prepayment of import duties on catalogs mailed to other countries. They should first ascertain the customs regulations of the country to which the trade literature is addressed. By ignoring these regulations many costly catalogs are either destroyed or returned to the senders. American firms contemplating sending trade magazines to Canada should comply with the strictly enforced regulations governing the delivery, within the Dominion, of trade literature through the mails in bulk. *Bona fide* trade catalogs and price lists not designed to advertise the sale of goods by any one person in Canada may be imported duty free in single copies addressed to merchants in Canada and not exceeding one copy to any one merchant for his own use and not for distribution. Large numbers of valuable catalogs mailed to Canada by American manufacturers have been returned undelivered owing to the refusal of the addressees to pay duty thereon. The total value of all of the separate pieces of matter should be first ascertained and duty paid, customs slips for which purpose are obtainable at the principal ports in the United States. Each piece of matter should have written or stamped on the outside wrapper or envelope the words "Duty paid." Catalogs and advertising matter sent in bulk as ordinary merchandise are also dutiable.

This village must go to accommodate the Taylorsville overflow basin

One of the contractor's dormitory buildings on the Englewood job

The Miami Conservancy Flood Prevention Plan

Construction of Large Retarding Basins

By W. A. Drake

IMMEDIATELY following the disastrous flood that inundated Dayton, Ohio, and the rest of the Great Miami Valley between March 23d and 28th, 1913, active steps were taken to prevent a recurrence of the disaster. A Flood Prevention Committee, whose function was to devise some means of protecting the city of Dayton, employed engineers to make a careful investigation of the underlying causes and to present some adequate means of preventing future similar disasters. The novel plan now being executed by the Miami Conservancy District is the result of the work of the Chief Engineer, Arthur E. Morgan, and his assistants.

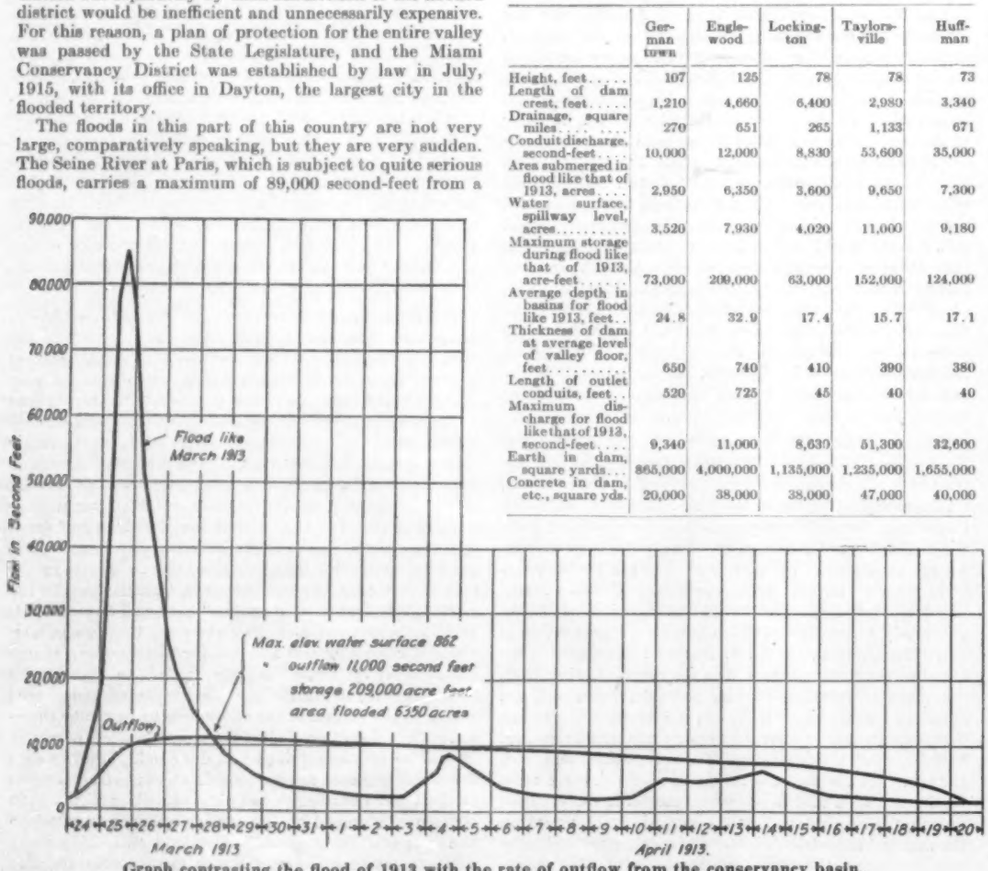
After the survey had been some time in progress, it became apparent that separate flood protection projects carried out separately by each subdivision of the flooded district would be inefficient and unnecessarily expensive. For this reason, a plan of protection for the entire valley was passed by the State Legislature, and the Miami Conservancy District was established by law in July, 1915, with its office in Dayton, the largest city in the flooded territory.

The floods in this part of this country are not very large, comparatively speaking, but they are very sudden. The Seine River at Paris, which is subject to quite serious floods, carries a maximum of 89,000 second-feet from a drainage area of 17,000 square miles, and the floods last between one and two months. The Miami has less than one-seventh the drainage area but with floods three times as great which, as a rule, are over within two or three days. These overflows rarely average more than 100 second-feet per square mile. The Dayton Flood caused a loss of 361 known dead and more than $66,765,574 worth of property. The total of deaths was undoubtedly much greater; the estimate is based upon the number of bodies recovered.

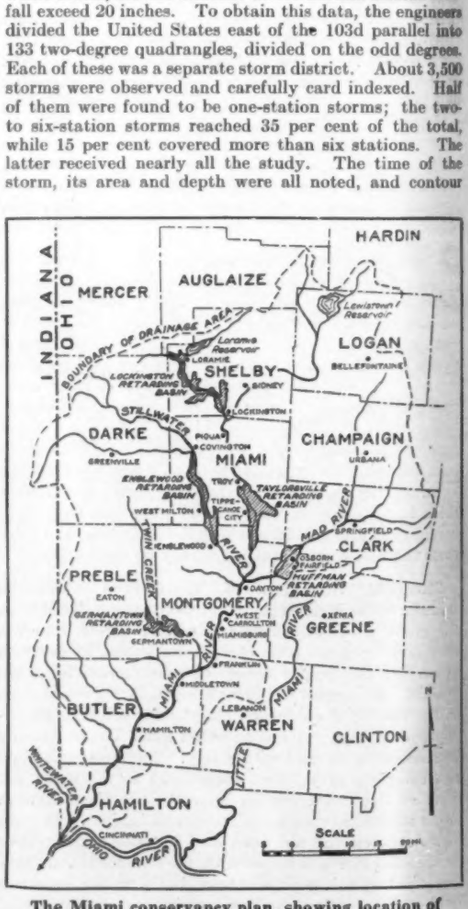
The original plan was to prevent floods by means of extensive channel improvements. A great many projects were considered and rejected. The problem confronting the engineers was entirely without precedent. Not only did they have to prepare for such floods and storms as were considered the average, but for the worst possible overflows.

The engineers analyzed the entire storm history and flood data of the whole country east of 103 longitude. District records were insufficient and several of the experts spent eight months in Washington abstracting the storm rainfall records. They noted all storms exceeding one inch precipitation in 24 hours, or four inches for the total storm, where the normal annual rainfall was below 20 inches; and all exceeding 10 per cent of the annual total in one day, or 15 per cent of the annual total in the whole storm, for the stations whose normal annual rainfall exceed 20 inches. To obtain this data, the engineers divided the United States east of the 103d parallel into 133 two-degree quadrangles, divided on the odd degrees. Each of these was a separate storm district. About 3,500 storms were observed and carefully card indexed. Half of them were found to be one-station storms; the two- to six-station storms reached 35 per cent of the total, while 15 per cent covered more than six stations. The latter received nearly all the study. The time of the storm, its area and depth were all noted, and contour

	German town	Englewood	Lockington	Taylorsville	Huffman
Height, feet	107	125	78	78	73
Length of dam crest, feet	1,210	4,660	6,400	2,980	3,340
Drainage, square miles	270	651	265	1,133	671
Conduit discharge, second-feet	10,000	12,000	8,830	53,600	35,000
Area submerged in flood like that of 1913, acres	2,950	6,350	3,600	9,650	7,300
Water surface, spillway level, acres	3,520	7,930	4,020	11,000	9,180
Maximum storage during flood like that of 1913, acre-feet	73,000	209,000	63,000	152,000	124,000
Average depth in basins for flood like 1913, feet	24.8	32.9	17.4	15.7	17.1
Thickness of dam at average level of valley floor, feet	650	740	410	390	380
Length of outlet conduits, feet	520	725	45	40	40
Maximum discharge for flood like that of 1913, second-feet	9,340	11,000	8,630	51,300	32,600
Earth in dam, square yards	865,000	4,000,000	1,135,000	1,235,000	1,655,000
Concrete in dam, etc., square yds.	20,000	38,000	38,000	47,000	40,000



Graph contrasting the flood of 1913 with the rate of outflow from the conservancy basin, had the latter then been in existence



The Miami conservancy plan, showing location of retarding basins

maps made and compared. The research into rainfalls and floods was monumental and exhaustive.

All this was necessary. The flood of 1913 was not a cataclysm as many believed it to have been. It could happen again and at any time. Although it was one of the greatest floods in centuries, certainly the greatest since the white man came, it might happen again on an even greater scale. Though unlikely, it is possible that the valley might be exposed to a storm, 20 to 25 per cent in excess of the 1913 limit. The district is working to provide for maximum floods by arbitrarily increasing upon the maximum estimated by the engineers. The protection of the valley depends wholly upon the system of retarding basins and channel improvements that are being made, so the engineers must go beyond their own judgment in the matter. The Conservancy system provides for from 15 to 20 per cent more overflow than is believed possible, and 40 per cent beyond the mark of March, 1913.

The Miami Valley is 120 miles long from northeast to southwest, and 50 miles wide. It contains 4,000 square miles at from 40 to 41 latitude and at an elevation of from 500 to 1,200 feet above sea level. It is one of the most important sections of the whole country from an industrial and military standpoint. In Dayton alone there are about 1,400 factories, including some of the largest in the United States. Recording and computing machines, cash registers, airplanes, sewing machines and tractors are only some of its products; it does much work of great wartime importance. The Wilbur Wright and the McCook Aviation Fields are also in Dayton, and the National Military Home. When all this is considered, the protection of the Miami Valley becomes a national problem, and it is being well taken care of.

(*Continued on page 299*)

Excavating with electric shovel for one of the dry reservoirs

Fossils Found in Eastern Colorado

By Lorena S. Ellis

A VISIT to the Colorado Museum of Natural History in the City Park of Denver, Colo., and a talk with the director, J. D. Figgins, regarding his recent discoveries in Yuma County of that state, takes one "into the past far as human eye can see," and then when the outmost boundry of real vision is reached the imagination keeps going right on backward into pre-historic times and sees Yuma County, Colorado, as it was when these same fossils formed the framework of living animals, about a million years ago.

Today Yuma County, in the extreme eastern portion of Colorado, is a treeless expanse of prairie with a soil of silt and sand, where dry farming is successfully carried on. A million years ago it was quite different. It was then, as was all of Colorado, a semi-tropical country with a dense growth of heavy vegetation. Back in the Mesozoic era there may have been trees, but in the time of the creatures whose fossils we are considering, the vegetation consisted of a rank, dense growth of long, succulent grasses, a growth prolific enough to sustain vast herds of herbivorous animals without any need of Hooverizing.

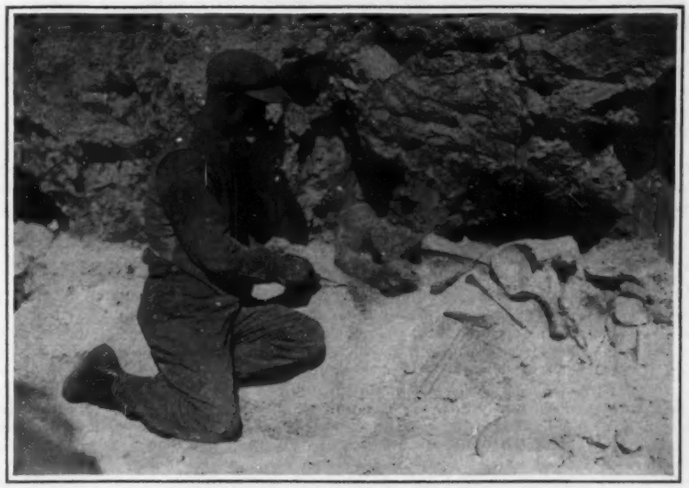
The first intimation that fossil beds existed in this locality came from H. D. Boyes, a ranchman living at Wray, Colo. Last March while prospecting he came upon some bones which he identified as being the leg bones of a rhinoceros. These he mailed to Mr. Figgins. In April Mr. Figgins joined him and together, with pick and shovel, they worked with all the zest of the early prospectors for gold. They soon found it to be more than a two-man job, so a force of men with teams was set to work at plowing and excavating. As a result of their summer's work there are now in the City Park Museum of Denver some acquisitions to the fossil collection of inestimable value, all of them being of the upper Miocene or lower Pliocene periods. Of the dog family, the most widely distributed of the families of *Fissipedia* at the present time, three distinct species were identified, one of these being a very large bear-dog of the middle Pliocene. This dog approached in size the largest of living bears, and could crush the stoutest bones with its massive teeth.

The most nearly complete skeleton found was that of the rhinoceros and Mr. Figgins says they expect to find enough bones to make it complete, having about one-fourth the number now. This animal was 13 feet long, 7½ feet high at the shoulder, and weighed 2½ tons. The rhinoceros had a long and varied American history and became extinct in the lower Pliocene. Judging from the present geographical distribution of animals few mammals could seem more exotic to North American life than do the rhinoceroses; yet according to an established authority the family probably originated here and subsequently spread to the Old World. The collection includes the leg bones, toe bones, and a nearly complete skull.

Of the horse family two, possibly three species were found. These were small, about the size of the present-day pony. Horses were the most abundant animals of that period, the lower Pliocene, according to Osborn, swarming in herds over the prairies. The evolutionary changes which have led from the primitive five-toed horse up to the modern horse are many and were brought about, as with all animals, by changing climatic conditions producing corresponding changes in vegetation.

Of all the fossils found by these prospectors none are more interesting than those of the camel, three species of which were obtained. One, the giraffe-camel, was 18 feet in height. Like the rhinoceros the camel seems completely foreign to North America yet, as a matter of fact, we find this family passed through nearly the whole of its development here, and did not emigrate to other continents before the late Miocene or early Pliocene.

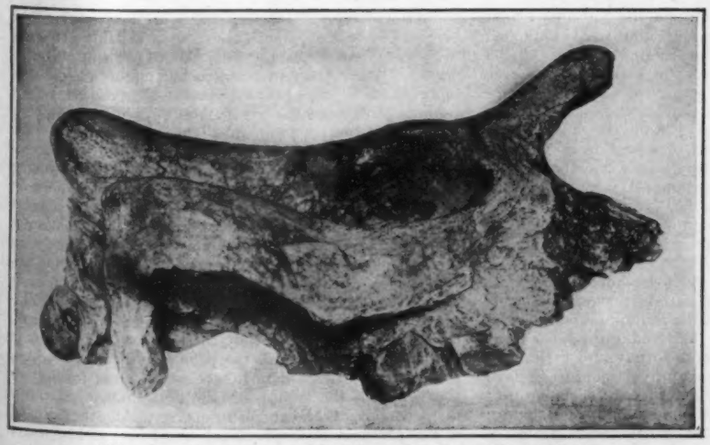
Of the mastodons two species were unearthed. The parts are, however, very imperfect, being badly broken but a complete lower jaw and complete tusks were found, also two or three leg bones, some vertebrae and separate molars.



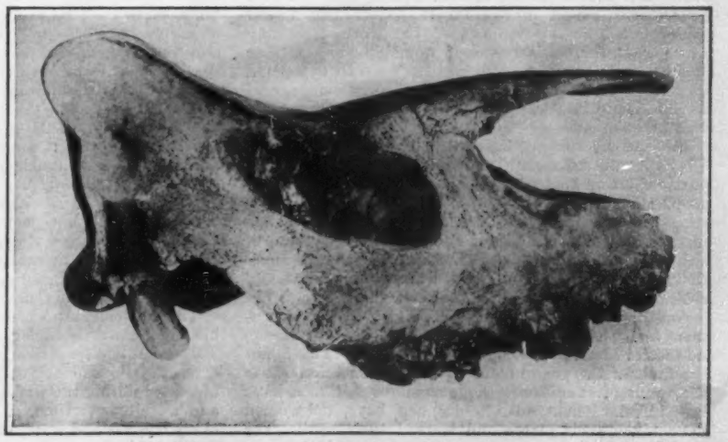
Mining for fossils in Eastern Colorado

This Mine Produces Coal and Sand

A MINING plant that is decidedly unique is located in Ohio. Both coal and sand are taken from the one property which consists of 150 acres. The surface strata is high grade molding sand and has an average depth of about nine feet. It is deposited on a bed of shale about five feet in thickness and under this is a seam of excellent coal averaging from 4 to 5 feet. Shipments of sand already have been made to foundries throughout the country. A considerable tonnage of coal also has been mined. As the shale strata is uncovered by the removal of the sand, steam shovels will be utilized to strip the shale, thereby exposing the seam of coal which will be mined in the open. In comparatively few localities is the coal seam sufficiently near the surface to permit of stripping. The sand is mined by steam shovel and is conveyed by mine cars to a stockhouse from which it is loaded into cars by a belt conveyor. A force of nine men can load 400 tons of sand a day.



Side view of a teleoceros skull from the Yuma County beds



A different type, characteristic of the aphylops

Reconstruction in Europe—V

"Labour"—Great Britain's Greatest Peace Problem

By C. H. Claudy, Foreign Correspondent of the SCIENTIFIC AMERICAN in London

SO many sided, so multitudinous in its ramifications, having so many different angles, Great Britain's labor problem is rather an unpromising subject for elucidation in a few hundred words. And yet, after having read many thousand words of reports, interviewed many government officials and attempted to gain a perspective on the English problem by looking at it from an American standpoint, its fundamentals stand forth with rather conspicuous clearness.

In the abstract, what all labor wants, the world over, is plenty of steady work, absence of fear of loss of work, good wages compared to the cost of living, and safeguards against the aggressions of capital. In the concrete, what British labor wants is a continuation of the benefits which war has brought it, minus the restrictions, changes and alterations in existing standards which are also the fruit of the great conflict.

In the abstract, what any government wants for its labor is to have it satisfied with its working conditions and its wages, so that there will be absence of strikes or lockouts and an internal peace of every man with his neighbor and with the capitalist for whom he works. In the concrete, what the United Kingdom wants for its labor is a reasonable adjustment of the war promises to labor, a moderate degree of patience with the inevitable upset due to the reestablishment of peace time conditions, and a sufficient degree of education and compliance of mind to permit the government to carry out those reforms which have been lumped in with readjustment under the much overworked name of reconstruction.

Thoroughly to appreciate the British problem, two facts must be born in mind always. The first is the extent and the variety and the power of trades-unionism in England. England has been, since the memory of man runneth not to the countrary, a country of classes. That it has been in the main a peaceful one does not disprove the fact that there has been a class war of considerable magnitude going on for a great many years. The landowner, the capitalist, the holder of rights and privileges on one side, the laboring man, the craftsman, the skilled artisan on the other, have fought a pitched battle. The result has been a great Labor Party which, if not yet in the position of the tail which wags the dog, is nevertheless of such size and power as to be a very large element in politics. Hence when the government made labor a promise, it was a promise not only to labor as labor but to labor as a voting power.

The second great consideration to be borne in mind is that never before in the history of the empire has it been required that labor lay down labor's point of view and take up the nation's point of view. For perhaps the first time, labor considered patriotism and country first, and its own welfare and its own private class war, second.

The hub of the matter is right here. It was seen at the very beginning of the war that the only way to win it was to have no stoppage of work from any cause whatsoever. So the government made a bargain with labor. Representatives of 30 great unions held a conference with the government representatives in March 1915, and agreed to do certain things, provided the government would do certain things. Labor agreed there should be no stoppage of war work, from any cause whatever. Differences in opinion as to wages or conditions or hours or anything else were to be settled in certain agreed-upon ways, but without stoppage of work. That was what the government wanted, demanded, and got.

But the government, in its turn, agreed to require of all its contractors and sub-contractors that any departure during the war from practices ruling in workshop, shipyard or other industries prior to the war should be only for the duration of the war. No change in practice due to war should prejudice the position of either individual or trades unions after the war, or affect the resumption and continuance after the war of any rules or customs existing prior to the war.

And now that the war is practically over the government finds that it cannot keep its promise in its entirety, no matter how much it may wish to do so. This is not the fault of the government nor of any one else. It is the result of conditions. Thousands of workmen have been killed. Thousands of older men, boys, and women have taken their places and learned their work. For the industry of the country at once to revert to pre-war conditions and instantly to throw all these "dilutees" out of jobs because, prior to the war, a trades union had ruled that a certain length of time was required before an apprentice could become a craftsman, and because the government had promised pre-war conditions in post-war days, would precipitate a national calamity.

It may be stated with little fear of contradiction that no such calamity is going to take place. Labor is by no means unintelligent and can see that the government is in somewhat of a dilemma. But it is reasonable to suppose that labor will make a good bargain if it makes a new one, and that if, so to speak, industry in general and the government in particular is "let off" some of the strict letter of its agreement, it will be at a price.

The problem is complicated by the process of demobilization and the resettlement, at the same time, of all the female help, the civil war workers, and the dilutees generally. During the transition period between the beginning of demobilization and the time when the country has in a measure begun to settle down to peace conditions, employment is apt to diminish, rather than increase. At the time when there will be the greatest demand for work, there will be the least work to be had. Many factories must go through a remaking process, scrap old machinery and get new, before peace work can be recommenced. There is bound to be a shortage of raw material because all countries will be trying to get them at once and because production of them is less now than before the war, and because shipping to carry them will necessarily be scant. Furthermore, there is always hesitation to engage in new work, especially construction work, in the face of high prices. As a final limiting factor there is a certain amount of dislocation of business and often of disappearance of selling organization due to the war.

Naturally, where labor is plentiful, and employment scarce, wages are apt to fall. Always a difficulty where labor is concerned, falling wage scales in the face of a high and mounting cost of living is a calamity which labor naturally will resist to the end. Trades unions will resist a reduction where they will not fight for an increase. With this factor the government has to reckon intelligently, to avoid disaster.

The three principal integers in the ability of labor to enforce its demands are of course the numerical strength of its unions, the financial resources of associations and individuals, and the amount of coöperation or amalgamation between the various classes of workers and their organizations. As instances of the numerical growth of unionism in England during the war, the National Union of Railwaymen has jumped from 273,000 to over 400,000 and the Amalgamated Society of Engineers from 170,000 to 287,000. As an instance of the fusions which give such power to the united societies, consider the case of the Worker's Union, the National Amalgamated Union of Labor, and the Municipal Employees Association, which in 1915 had a combined membership of 176,000, and have now an amalgamation and a membership of over half a million. The National Union of General Workers, and the Dock, Wharf, Riverside and General Worker's Union have combined with a membership of 400,000. Altogether there are in the United Kingdom some 1,100 trades unions with a membership of 4,500,000 and it is particularly to be noted that while unions are decreasing, unionists are increasing.

The financial status of both the individual worker and his union have been largely bettered during the war. The union had no strike benefits to pay and little legal expense. Both money wage and proportional wage have increased during the war, the latter from "speeding up" and working overtime. Employment has been steady; every one has had work, and many households, formerly supported by one worker, have had their entire personnel, down to the children, become wage earners. On the other hand, there has been little opportunity for orgies of spending. Food has been buyable only *via* a coupon. Drink has been rigidly held within bounds and could be had only at certain much circumscribed times. Luxuries were frowned upon, partly from patriotism, partly because there were few luxury factories at work! The result has been a certain amount of compulsory saving, so that perhaps never before have the people who stayed at home and worked been in a better condition financially to engage in any renewal of the class war of labor against capital.

If this seems a somwehat gloomy picture the canvas is not without its brighter colors. Of course, perhaps none deserves greater attention or will have a more far reaching effect in the solution of the problem, than the educative effect of the war and war labors both upon those who have fought and upon those who have labored at home.

Labor has learned of its government from the inside. Government is no longer a strange extraneous force which must be combatted. The "agin th' government" attitude of many laborers who never saw an Irishman, is no longer a commonplace. Administration of rationing systems, which affected high and low alike; the allowance for the disabled soldiers; health provisions for munitions workers; the strict limitations of profiteering capital—all these have done their parts in the education of the average worker to consider his government as something which belongs to him, not something which is a thing apart. And it must not be forgotten that if labor gave up strikes and accepted compulsory arbitration during the war, it received at the same time a measure of recognition from both government and individual industry for which, in many cases, it has striven vainly for many years.

It is endeavored here merely to outline the main elements of the problem, to show only the question in its broadest and most catholic aspect. The expert labor statistician may well quarrel with any discussion of the problem which leaves out of consideration those factors, such as the relation of the skilled to the unskilled, the growing feeling of labor's confidence and strength due to the heavily restrictive measures which have kept capital from its favorite course of charging all the traffic would stand, and the political aspects of the subject. But it seems as if the question at issue is too clear-cut either to need elucidation by such added discussion or to be benefitted by the inclusion of a wealth of details. In the largest sense, the labor question is one of available work to be done and available hands to do it, of prices to be paid and laws and regulations under which the worker may have the fullest life, while leaving to capital that measure of profit without which capital will not come from its vaults and hiding places.

In Great Britain, as elsewhere, the answer to the problem is easy to formulate, if difficult to work; coöperation between labor and capital; education of the worker; education of the capitalist to the needs of the worker, even if they limit his profits; and finally, a measure of patience on the part of every one during the period when the government is doing its best to relocate soldier, sailor, woman-worker, child-worker, adult-worker, in the place best suited to individual abilities and earning powers.

But in Great Britain, perhaps more than in most and certainly more than in many other countries—notably more than in the United States—the government is taking active steps to solve its labor problem as a problem of *all* the people, a problem of the whole nation. How much of this is due to the labor elements in the government and how much to governmental awakening under the illuminating and upsetting effect of the war on tradition and class prejudice, there will be no attempt here to say. Suffice it that it is so. The association of labor with employers in the management of industry seems well assured by the adoption of the Joint Industrial Councils idea, as proposed by the famous Whitley committee. The National Alliance of Employers and Employed is a new sort of union for England, and seems to mark definitely the passing of autocracy in industry. Of course, all the problems which have been labor's difficulties are no less existent than formerly—the worry of the "dilutee," the nightmare of scientific management, the horror of intensive effect, the torment of the prospect of employment, the hades of low wages

(*Continued on page 300*)

WHEN the citizen army demobilizes, its members go back to their jobs—to find these filled, and acceptably filled, by women, boys, older men, and men physically unfit for military service. One of the vital problems of reconstruction, the world over, has to do with the readjustment between these two classes. In the present article, the fifth of his series on European reconstruction, Mr. Claudy shows what this problem means to Britain, and outlines the direction which its solution must take.—EDITOR.

How Will the Gasoline Engine Develop?

Some of the Things That Intelligent Imagination Sees in the Future

By Howard Warren

WHEN the war broke out the gasoline engine was making steady, if not particularly rapid, progress. For several years attention had been directed to the improvement of details and the solution of minor problems, the general design remaining unchanged. The period of rapid progress that followed the realization, a quarter-century ago, of the possibilities of internal combustion, had passed; as an accepted power unit, the gasoline engine had acquired, with its acceptance, more or less of an accepted form. Its evolution toward whatever it is ultimately to be was taking its normal, deliberate course—one which ordinarily is satisfactory enough.

The war, however, brought new conditions and new demands. It brought the demand that the gasoline engine be made a much better machine without waiting for the lapse of sufficient time for the ordinary evolutionary reactions. The immediate effect was a quickening of effort, with the determination to bring the future back to the present—to do today things that under less strenuous conditions would have been left for next year, or even for five or ten years hence.

The pressure of wartime necessity has resulted in the accomplishment of much, and has started lines of effort that are more or less certain to lead to remarkable endings. Just what has been done, just what has been started and not yet finished, we shall not know until silence has become an altogether unnecessary precaution. But if fragmentary hints are not entirely misleading, there will be revelations that will open many an eye. Some of the results are known, others are not; a great deal is left to the imagination.

Leaving a matter of this sort to the imagination is nothing more or less than an invitation to speculate against the future. What latent possibilities are there in the internal combustion engine? What undesirable qualities does it possess that may perhaps be eliminated?

Today the most conservative of engineers hesitates before using the word "impossible," even though possibility may be utterly obscure. In the past many have used this word who were eminent men, as well qualified to express opinions as the contemporaneous state of the engineering profession then permitted. Where they erred was in making all their calculations *in the light of what they already knew*, failing to take into consideration the unknown quantity of future knowledge which might—which did—entirely upset prognostications.

There is, then, ample justification for speculating a little as to the future possibilities of the internal combustion engine, without gazing too intently into the undeniably bright light of existing knowledge and being blinded by it. The fact that something is utterly impossible today means only one thing—that we do not yet know how to accomplish it. It by no means indicates that we shall never know how to accomplish it. So let us speculate a little.

The thought that turns up automatically is that of the internal combustion turbine. But while that type of motor will doubtless come into being, without reciprocating auxiliaries or attendant drawbacks of other sorts, there is plenty of room for the imagination to play in, without going beyond the familiar reciprocating engine of today. In fact, it is necessary merely to take thought of some of the commonplaces of engineering.

For instance: when we feed to a gasoline engine 100 heat units in the shape of fuel, all we get back in the form of power is the equivalent of about twenty-five heat units. Using easy, round numbers, it appears that something like 10 per cent of the fuel burned is used to generate the power to overcome the friction of the moving parts; that 30 per cent is literally and intentionally thrown to the winds—abstracted from the cylinder walls by the water jacket, carried to the radiator, and dissipated in the rush of cooling air; that 35 per cent goes straight out through the exhaust pipe. So it is necessary to buy and carry around and handle and provide space for three gallons of fuel for every gallon that does useful work. Right there is a vast field of possibilities—a field 300 per cent greater than that of actualities.

If the steam engine were as prodigal of heat as is the gasoline engine, it would be a hopelessly inefficient piece of apparatus. Once steam reaches the cylinders, however, it is handled with the most painstaking care so that not a heat unit shall be lost that it is possible to save. What heat is left after the first piston has been moved is transferred to another cylinder and set to work on another piston, even unto the third and fourth expansion. When the steam is too old and feeble to push pistons it is suddenly condensed and made to do work on the other side of the pistons by leaving a vacuum. Finally the heat still left in the water is saved by going back into the boiler with the feed-water.

Compare this with the beautifully simple process of the gasoline engine. At the end of the stroke a valve opens and 35 per cent of the power that has been created is shot into the air through the exhaust pipe, while 30 per cent is blown away by another route—neither exit being big enough to pass all the heat that must be wasted.

These things are done because we do not know any way to avoid them. Elimination of the cooling system would allow most of the heat carried off by the cooling water to remain in the cylinders; but with existing engines the result would be merely a small increase of power for a few revolutions, followed by stoppage through overheating. Increasing the temperature of the cylinder walls beyond a certain point first destroys the lubricating qualities of the oil; and without oil we do not at present know how to make an engine run. Even if we had an oil that would stand all the heat we could generate, however, we could not advance much further; for we should have excessive expansion to contend with, while the metals we use for cylinders and pistons would

(Continued on page 302)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

"Second Sight" or Looking Glass?

To the Editor of the SCIENTIFIC AMERICAN:

In a small book entitled "Psychical Research," one of the series issued as the "Home Univeristy Library of Modern Knowledge," occurs this paragraph, describing the result of an experiment with reference to mental transference:

"Object: a pair of scissors partly open, points downward. Percipient says, 'It is a pair of scissors standing up, a little open.' Object: a key. Percipient: 'It is bright, it looks like a key.' Told to draw it, the percipient drew it inverted. Object: outline drawing of a little flag. Percipient: 'It is a flag.' Told to draw it, she drew it as it was, upright; but laterally inverted. The frequent lateral inversion of objects by other percipients I have also noticed. A different drawing was next made, but put aside and purposely the drawing of the flag again put up. Percipient: 'I still see the flag.' Object: an oval locket, hung up. Percipient: 'I see something gold, something hanging, like a gold locket.' Asked what shape, 'It is oval.'"

Now in view of the fact that some of the minute reflectors used by card manipulators and conjurers give an inverted or reversed image, should not all cases where the "percipient," using that name at its face value, draws the object reversed in any direction, be ruled out as frauds?

A. R. WARD.

Sydney, N. S. W.

The Science of English Spelling

To the Editor of the SCIENTIFIC AMERICAN:

In a letter in the SCIENTIFIC AMERICAN of Dec. 21st attention is drawn to the importance of a Universal alphabet. To make one would be a big program. A much smaller program would be the scientific representation on paper of the sounds used in standard English speech. Usage has in the course of centuries done most part of the work. She had only 26 letters of the alphabet to work with and she had far more sounds to represent; so she invented digraphs and trigraphs and tetragraphs, and with them she had far and away more means of representing sounds than she had sounds to represent. One sound she represented in 23 diffefent ways; another sound in 18 and so on. For many sounds there is a regular *embarras de richesses* of ways. "Now ladies and gentlemen," Usage says, "it is up to you to decide." But unanimity has in many cases never been come to. The S. S. S. of England has made proposals, but no one seems to think them quite satisfactory. The S. S. B. of this continent proposed to advance more cautiously, but somehow no one seems inclined to follow the lead. "Perhaps you may lead us wrong and make things worse than ever," people seem to say.

No doubt some digraphs that Usage has introduced are as well established as the most fundamental letters of the alphabet. We have, for example, the digraph ch which might be called chay, and the digraph ng, which might be called ing, and the digraph sh, which might be called ish, and the digraph th, which has to represent two sounds and might have two names ith and thee. All these digraphs are part and parcel of our system of representing on paper the sounds of our speech.

The letters a, e, i, o and u Usage has appropriated to the representation of the sounds called short a, short e, short i, short o and short u as in the words pat, pet, pit, pot and but.

Then Usage had the sounds long a, long e, long i, long o and long u to provide for and she sometimes represented them by the letters a, e, i, o and u, as was only natural as the letters have the names of the sounds. Usage also tried those letters followed by a consonant and then by an e as in the words mate, mete, mite, mote and mute. But that was not very satisfactory. Usage also tried well nigh innumerable digraphs and other graphs. And there is a regular battle raging whether the digraph ee or the digraph ie should represent the sound heard in the English name of the letter e. And there is another furious battle for the honor of representing the sound heard in the English name of the letter I. And there are minor engagements, too.

I have written a pamphlet about the matter called "The Science of English Spelling" and I would send a copy of it post free to any of your readers who would do me the honor to write for it.

WM. CUTHBERT HOLMES.

Millstream, B. C.

Bamboo Pipe Organs

To the Editor of the SCIENTIFIC AMERICAN:

In the article on page 328 of your issue of October 19th last, you say: "It is stated that there is one other bamboo organ in the orient but it is not possible at this time to secure definite information relative to its whereabouts or condition."

It may interest you to know that there is a bamboo organ in the parish church at Las Pinas, a municipality on the bay eight miles south of Manila. It was begun in 1818 under the rectorate of Father Diego and finished in about 1823, damaged by the famous earthquake of 1863, partially repaired, but then neglected until recently. It is now playing.

It contains 832 bamboo pipes and 121 metal pipes (buglers) outside the organ.

It contains 23 stops, 12 on the right and 11 on the left.

1—Light trumpet	1—Counter-base
2—Accompaniment trumpet	2—Bugler
3—Major flute	3—Major flute
4—Violin flute	4—Major violin
5—1st octavo	5—1st octavo
6—2d octavo	6—2d octavo
7—Docena primera y segunda	7—1st docena
8—Quincena primera y segunda	8—2d docena
9—German flute	9—1st quincena
10—German flute (buglery)	10—2d quincena
11—Piccolo flute	11—Nightingale
12—Drum	

The keyboard, contains five octavos.

The 19 tonic major notes first to the left have similar sounds and the 17 chords to the right have different tones; the tones begin from the seven last major notes to the left. There are 12 pedals.

The drum and nightingale sound like those of other organs, but by pouring a little water in the deposit, it produces the song of birds and for that reason the organist on Christmas Eve has always a bottle of water by his side to use when he wants the enchanted birds to sing.

The bamboos have never been painted or varnished according to the oldest man of the locality, but when they are wiped with a wet rag they appear to have been varnished.

The original pipes still remain in a state of remarkable preservation, but it has been found that the new ones were subject to decay and the attacks of insects.

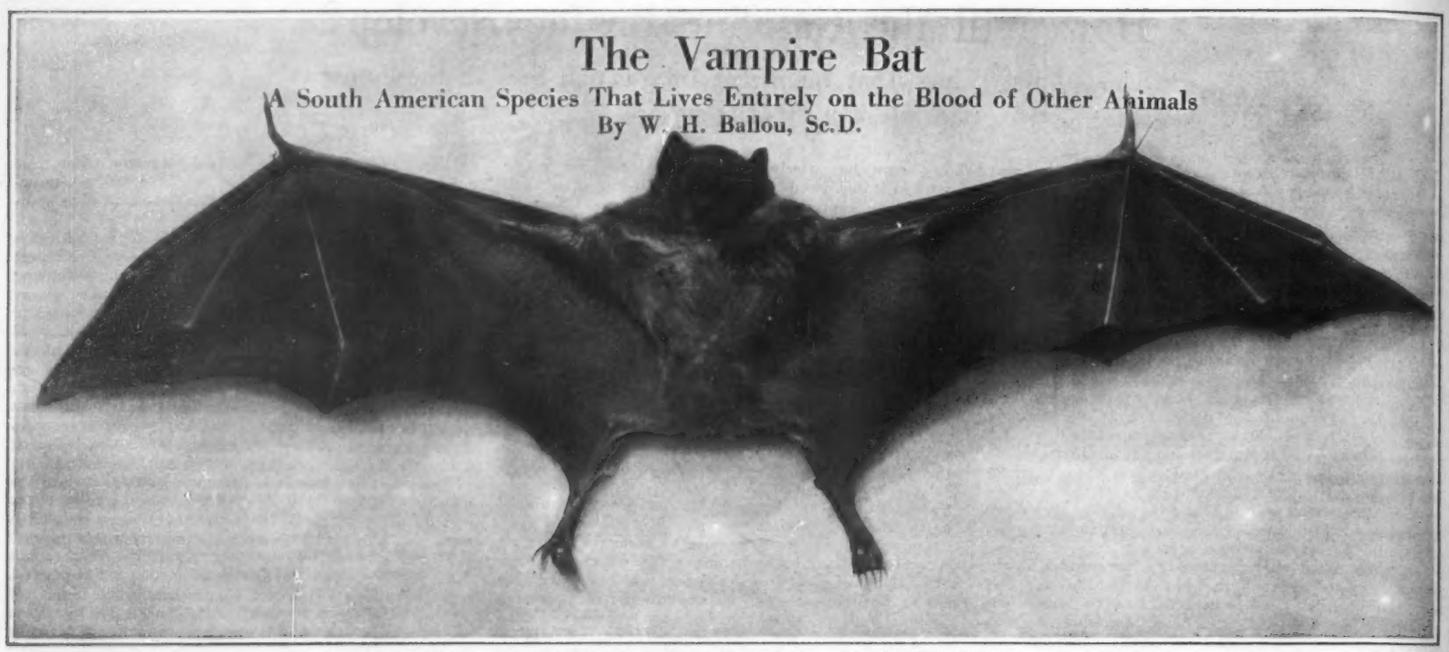
THOMAS CARY WELCH.

Manila, P. I.

The Vampire Bat

A South American Species That Lives Entirely on the Blood of Other Animals

By W. H. Ballou, Sc.D.



The only photograph of the vampire bat to be found in the United States

LIEUT. LEO MILLER, U. S. A., engaged for six years in making a zoölogical Survey of South America for the American Museum of Natural History, New York, has turned in to that institution more than 100 specimens of the vampire bat, together with other and large collections of new birds, mammals and reptiles. These bats will now undergo an intensive study by men of varied branches of science, in order to add to our heretofore slender knowledge of the only true vampire known. The late Colonel Roosevelt declared the existence of this nocturnal menace to all animal life, on his return from his Brazilian expedition. It remained for Lieutenant Miller, however, to risk his life to capture a large collection of the midnight assassins for study and exhibition.

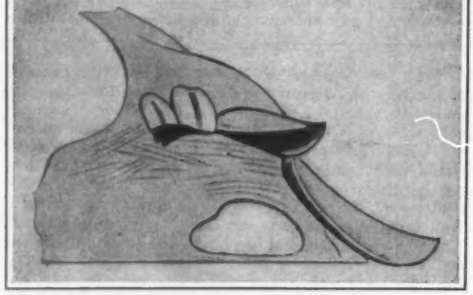
Lieutenant Miller has further distinguished himself by writing a book on his explorations, entitled "In the Wilds of South America," from which much of the following statement concerning the vampires is abstracted.

"The trail from Cochabamba goes up steadily until an elevation of 12,000 feet is reached. Beyond the high summit of the first ridge lies the high mountain valley in which is located the Quechua village of Cuchiancha, meaning 'pig pen.' The trail leads eastward to an elevation of 13,400 feet. . . . We had traveled to the Yungas on mules owned by the expedition, and upon our arrival turned them loose to feed as usual.

"Next morning, the animals were in a sorry plight. They had been visited by vampire bats during the night, and bled so badly that we had to send them back to Locotal without delay. Severe as this attack seemed to be, it was mild compared to what we were to see later on. We discovered clumps of small bats, gulity of the execution spending the days under the roof of our hut, and despatched many of them, but this made no impression whatever upon their vast numbers. Humans, also, are bitten on any part of the body which is left exposed at night, and I have frequently seen Indians who had been attacked on nose, forehead and arms. . . .

"The forest of Todos Santos . . . was full of surprises. At night vampire bats came out in hordes; they attacked everything from human beings down. Even the few miserable pigs kept by the Indians were severely bitten and kept up a continuous squealing as the blood-thirsty creatures settled on them, usually at the base of the ears, and began their painful operations. The worst sufferers by far, however, were our mules. As soon as the sun set our peons brought the animals to the corral and strapped canvas covers over them, a precaution of little avail, for the bats attacked the exposed parts, causing the mules to kick and roll, with the result that their covers were soon torn off.

"We went out frequently to watch these obnoxious creatures at work. After circling above their prospective victim several times, they dropped suddenly, usually upon the neck or flanks, and at once began to bite and suck, making a grating sound with teeth all the while. They paid no attention to us, although we stood but a few feet away, but clung with folded wings to their prey, perfectly motionless and in an upright position. If we moved



The upper incisor which serves the vampire bat in puncturing the hide of its victims

they uttered a few squeaks, but made no attempt to fly until we reached for them and came to within a few inches, when they reluctantly fluttered up, but almost immediately settled on the other side of the animal. . . .

"In the morning the mules were in a pathetic condition, blood continued to flow from the wounds made by the bats' sharp teeth, so that the ground was red and the animals were covered with blood from head to foot. It was always necessary to take them to the river and wash them, then disinfect the numerous punctures. If this is not done, flies attack the sore spots, infesting them with their larvae, and the animals die of blood poison. After three nights we were compelled to take the mules back to Cochabamba, as they were on the verge of exhaustion."

Colonel Roosevelt's mule, which was almost destroyed by the vampire bats in Paraguay

Of all the world's creatures met by Colonel Roosevelt in his explorations for the Smithsonian Institution and the American Museum, he found the vampire bat the super-monster of iniquity, compared with which, Armageddon and malefactors of great wealth were as nothing. In his work, "Through the Brazilian Wilderness," he says:

"We were now in the land of the bloodsucking bats. (Sepotuba River, Paraguay.) These are the vampire bats that suck the blood of living creatures, clinging to or hovering against the shoulder of a horse or cow, or the hand or foot of a sleeping man, and making a wound from which the blood continues to flow long after the bat's thirst has been satiated. At Tapirapoan there were milch cattle. One of the calves turned up one morning weak from the loss of blood, which was still trickling from the wound, forward of the shoulder, made by the bat. In places, not only mules and cattle but chickens have to be housed behind batproof protection at night.

"The offenders are of various species. One of the Brazilian members of our party, Hoehne, the botanist, was a zoölogist also. He informed me that he had known even the big, fruit-eating bats to take to blood sucking. They did not, according to his observations, themselves make the original wound; but after it had been made by one of the true vampires, they would lap the flowing blood and enlarge the wound. South America makes up for its lack, relatively to Africa and India, of large man-eating carnivores, by the extraordinary ferocity or bloodthirstiness of vampire bats of which the kinfolks elsewhere are harmless. It is only here that fish no bigger than a trout kill swimmers, and bats the size of the ordinary 'flittermice' of the northern hemisphere, drain the life blood of big beasts and man himself."

The vampire bat, exclusive to South America, is known to science as *Desmodus rufus*. To meet all the requirements of a true vampire, it is perhaps the most highly specialized animal in existence, not excepting man himself. As a good guess, the vampire bat may be said to belong to the exclusive faunae of South America, arising successively from ancestors, the remains of which have neither been found in fossil form nor in existing forms yet discovered. Their relationship to other bats of the world, of which there are at least 2,000 species, hangs on several minor

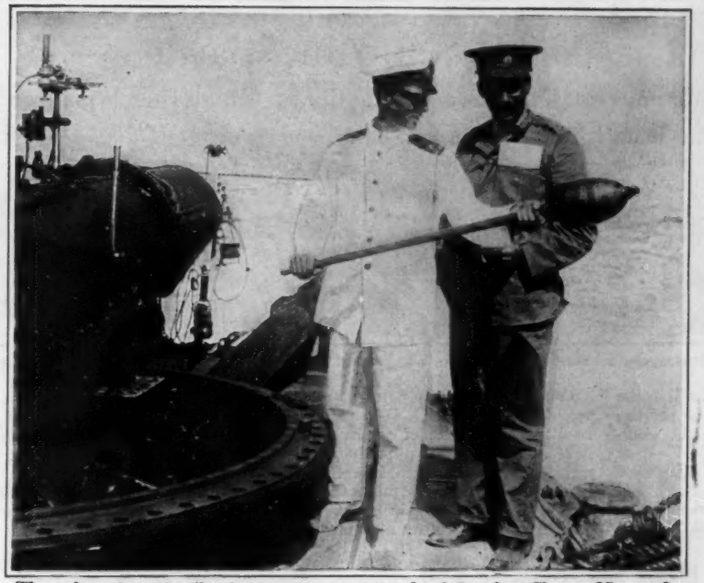
characters. These or similar structural characters are found in the family of bats known as the *Phyllostomidae*, a North American tribe of fruit eaters having small leaf noses. Miller says: "They are like the Phyllostomidae in respect to wing, pectoral girdle, and pelvis, except that the tuberosities of the humerus (upper arm) are more nearly equal in size. The fibula (lower leg bone) is large, extending to the head of the tibia (shin bone). All of the long bones of the leg and wing are deeply grooved for accommodation of the muscles. The teeth are highly specialized for cutting, all trace of the crushing surface being absent. The cheek teeth are so reduced that the length of the entire upper row is less than that of the canine teeth. The stomach is a slender structure. The nostrils are surrounded by dermal outgrowths that form a very rudimentary nose leaf."

I examined the South American specimens in the American Museum, both skeletons and skins. The blood sucking characteristic comprised two large, projecting upper incisor teeth, which worked perfectly with two lesser lower incisors. These with two lancet-shaped superior canine teeth, were all sharp pointed and so arranged as a whole as to make a triple puncture, like that of the leech. The tongue is capable of a considerable extension, furnished at its extremity with a number of papillae (nipples), forming an organ of suction.

Most peculiar, however, is the fact that in its process of evolution away from the ordinary bat functions, and in order to become a true vampire, the creature has consolidated all of its intestines into one tube, or alimentary canal. It has no other intestinal organ whatever, and in consequence, nothing but a liquid can pass through it. Just what must we conclude from this? Some of the lowest forms of animal life having only an intestinal tube, digest food as fast as it enters them. There is a process of simultaneous feeding and digestion. It might possibly be assumed that the vampire bat, in gorging itself with the blood of another animal, having no reservoir in which to store it, is somehow able to digest it simultaneously, and rapidly assimilate the essential constituents entirely through its own system. Or on the other hand, its intestiniform tube may be capable of more expansion than shows under a superficial examination, so that the bat may be able to store in it a considerable amount of pilfered blood, retiring to its retreat to hang up by its feet during daylight, digesting at leisure. There is also the possibility of something in each of these surmises. The fact remains, however, that the vampire seems to take in more of pilfered blood than its bodily capacity. It must be noted at the same time, that blood contains a large percentage of water, and for this reason does not form a very substantial food from the human standpoint.

The bat is unquestionably not only the oldest but the first mammal. It seems to have arisen direct from some unknown type of reptile that aspired to safe aviation rather than crawling, walking or running. While it bears much resemblance to some of the prehistoric flying reptiles, the structure of its brain case shows little or no affinities in that direction. An external parallel is there, little more. The bat,

(Continued on page 303)



The submarine "dart"—the forerunner of the depth bomb. Charge 25 pounds of TNT. Fired from a one-pounder gun

Submarine Dart—Progenitor of the Depth Bomb

THE depth bomb, which by the close of the war had grown to the great weight of 600 pounds, began in a very modest way. Someone in the British navy conceived the idea of throwing a high-explosive shell which would reach the submarine under water, and the device shown in our illustration was developed. It consists of a shell containing about 25 pounds of TNT the shell being mounted on a shaft. The shaft served the double purpose of filling the bore of the gun from which the dart is fired, and also of maintaining an end-on position during flight. This particular size of dart was probably fired from a one-pounder gun. The device is in the same class as the rifle grenades which were used in trench warfare. No great success was attained with these instruments, probably because the charge was too small for effective under-water work; but the principle of under-water attack by high explosive was recognized as sound, and out of this dart came the depth bomb, which increased in size to 100, 200, 300, and finally, just towards the close of the war, to 600 piunds. This photograph will have historical significance, as indicating the first step in what proved ultimately to be the most effective anti-submarine weapon of the late war. There can be no doubt that the U-boat commanders greatly feared this deadly weapon. As soon as the Allied destroyers and chasers were fully equipped with it, the Germans feared to close in for attack on the convoys.

U. S. Navy 7-inch Caterpillar Mount

By H. Delano, Commander U. S. N.

FROM the moment the United States entered the war it was a foregone conclusion that the Hun was in for action—swift, decisive action. Americans are fond of action; they also believe that the safest defense is a strong offense, and they lost no time demonstrating the theory. Logically they began on the sea, for millions of troops had to be transported. Depth charges turned the trick. Ten were sent on their errand of destruction where one had gone before. The results were soon apparent; crews of pirate craft no longer laughed at their pursuers nor enjoyed a moment's safety after leaving the home port. Their morale suffered and those who escaped with their lives broke under the terrifying strain and the sea was safe.

On shore the Hun was treated to another surprise-action which first disconcerted, then dismayed him. Enraged, he attacked but was met in the open and repulsed. He set up a terrific bombardment, but every shell was returned ten-fold. It made him nervous and jumpy for the game was a new one. In every duel with short and medium range guns the American Army was victorious. There was ammunition a-plenty for guns of every caliber, but unfortunately in the early stages of our participation, high-powered artillery was scarce. Without fairly long-range guns the enemy could not be prevented from massing in rear of his lines.

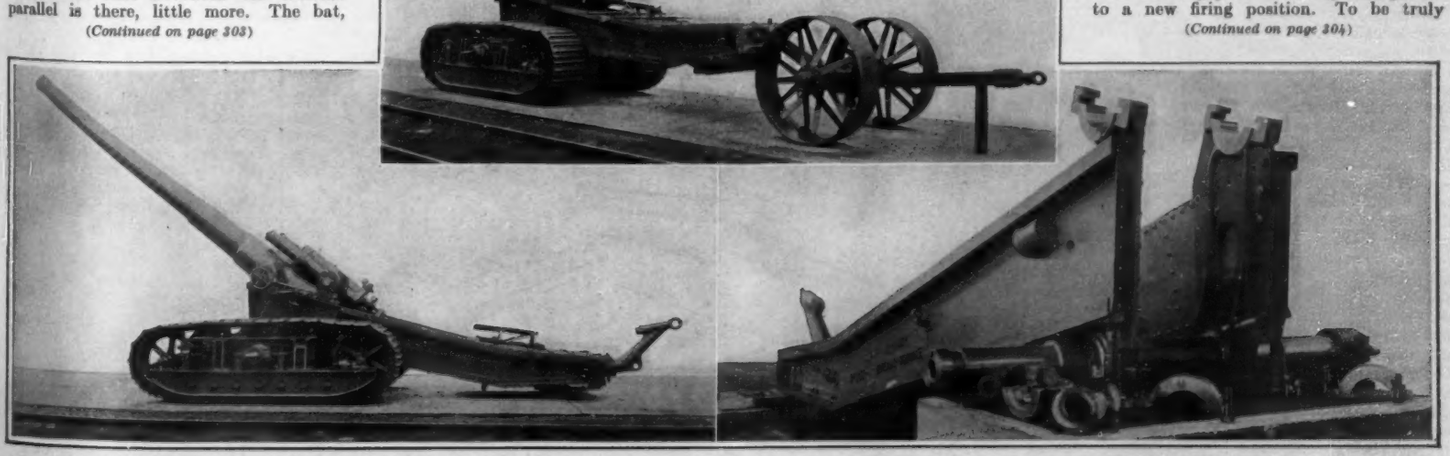
It happened that the Navy possessed some high-powered seven-inch rifles and it was thought they would be effective if mounted on light railway trucks. Marines were eager to man them. Pershing was willing, so designs were hurriedly completed and arrangements were being made for manufacture when a major of marines assigned to command the artillery regiment, strolled in to see what sort of weapon he was slated to wield. After a few minutes silent inspection of the plans, he naively remarked, "When the marines break through we don't want to wait while track is being laid, we want to follow right up with the artillery. Can't you give us something else?" We could—we had to after such a quiet display of confidence.

A seven-inch gun capable of launching a projectile at 2,800 feet per second is necessarily heavy. This one weighs 28,700 pounds. To mount it on wheels sufficiently large to carry the deadweight plus the live load thrown upon them at the instant of discharge was an easy matter, but to build a mount on wheels so that the major might "follow right up" without an instant's delay was out of the question—the wheels would be entirely too large. A caterpillar mount was the solution.

But little investigation was necessary to learn that there were no caterpillars on the market sufficiently strong and rugged for the task. They had to be designed. Within 40 days the Naval Gun Factory had solved the problem and the first adoptation of the caterpillar to the mounting of heavy, high-powered rifles was perfected.

In order to ensure mobility, the prime requisite was a mount which required no disassembling prior to being transported to a new firing position. To be truly

(Continued on page 304)

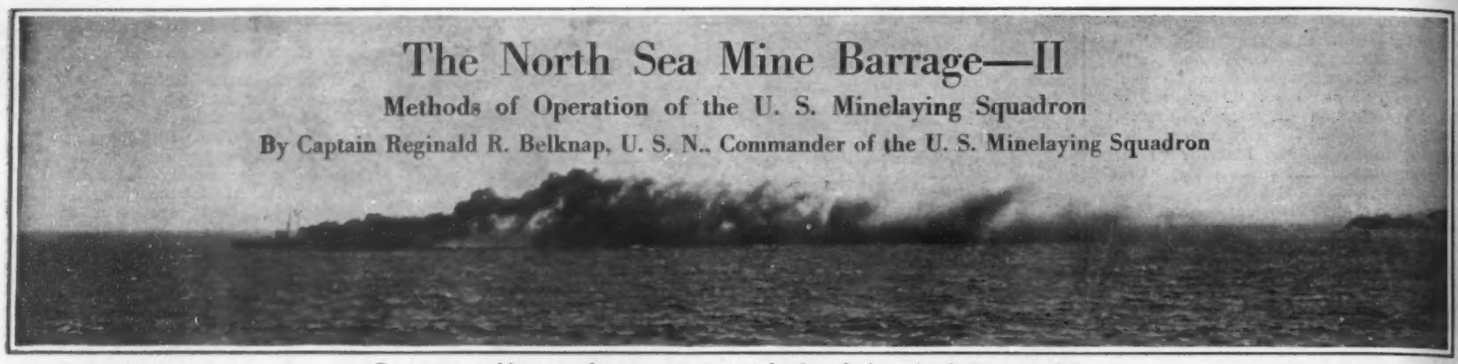


The seven-inch gun on caterpillar mount. Left, at 40-degrees elevation; above, ready to advance with the infantry; right, the trunnion bearings, the plates, trail and axle

The North Sea Mine Barrage—II

Methods of Operation of the U. S. Minelaying Squadron

By Captain Reginald R. Belknap, U. S. N., Commander of the U. S. Minelaying Squadron



Destroyers making a smoke-screen to protect the fleet during mine-laying operations

THE whole "Yankee Mining Squadron," as it came to be known, deserves mention by name, as per the accompanying table, which gives the principal characteristics of the individual ships.

The squadron formed the seagoing part of the Mine Force, under Rear-Admiral Joseph Strauss, U. S. N., headquarters at Inverness, his command embracing also the force on shore, and the repair ship "Black Hawk," Capt. R. C. Bulmer, U. S. N. The minelayers arrived May 25th, 1918, on time and ready for business, notwithstanding their state of chaos less than two months before—in fact, the squadron was never the cause of any delay and never failed in any operation. It was arranged that, upon 48 hours notice, Admiral Beatty, of the Grand Fleet, would issue the orders for a mining operation, send a destroyer escort, and designate one or two battle or battle-cruiser squadrons and a light cruiser squadron, as a support against a possible raid. Though the two minelaying squadrons often went out at the same time, they operated in company only twice. There were 13 American operations, 11 British, and of the final total, the American Squadron planted 56,571, or four-fifths, and the British 13,546.

Early in June, preparations were going full blast for the first minelaying operation. On shore the mine parts were tested, adjusted, and assembled, then the completed mines were sent by rail to the waterside for loading into lighters, to be towed off to the ships. After landing on the tracks on board, each mine was tested, for any derangement in the three handlings in transit from the base. By June 6th, everything was ready for departure at midnight. All possible secrecy had been observed, because information could be sent through to Germany in 18 hours or so—time enough for them to hatch out some kind of interference.

Going out on a mining excursion—a word adopted for its cheerful suggestion of a return, tired but happy—our squadron's two detachments and the destroyer escort would unite just outside Cromarty, the minelayers forming in two columns, with the destroyers, usually 12 in number, spread in a screen ahead and on the flanks. The squadron flagship "San Francisco" always led one column and was guide for the whole force. The instructions for these excursions were as comprehensive as foresight could make them, while allowing ample discretion for emergency. All captains and the escort leader, usually Captain Godfrey, R. N., in H. M. S. "Vampire"—were furnished memoranda of the intended courses and distances, the mining order prescribed, the successive formations and any special procedure, and a planting schedule, accurate to the second, prescribed when, and how many mines each ship was to plant. Once started, the planting could continue as intended, even in fog or darkness—in both of which conditions we laid mines several times, eight ships in line abreast, 500 yards apart, steaming at 12 knots.

Our courses led through waters where mines had to be swept for constantly. We steamed day and night in the regular throughfare of enemy submarines. The minefield area had been publicly notified three months in advance, to warn neutral shipping—and the enemy might easily have strewn some mines there on the random chance of getting us. One ship blown up would have disabled or destroyed the other nine also. And as the planting progressed, we had to make use of navigation buoys, planted in the open sea, obviously for our use. The British had warned us from their own experience of the enemy's habit of moving such buoys whenever seen, or planting mines near them—sometimes doing both. Besides these exterior risks, there was constant danger from fire. The converted ships were full of woodwork, and what might have happened was shown since our return home, by the rapid spread of a fire in one ship, the night after she had cleared herself of mines. The sleeping officers had to escape in their night clothes, and the men in the engine room were barely able to attend the pumps without suffocation.

There was the further chance of a surface raid. The destroyer escort was prepared to engage its own kind, as well as submarines, and even to make a sacrifice attack on light cruisers, to assist our escape; but our moderate speed—15 knots at best when keeping together—and the small number and caliber of our guns, made us rather helpless against an enemy cruiser's long range, six-inch gunfire and 28 knots speed. Moreover, when the enemy began to feel the barrier's restriction on his submarines operations, it was expected that he would attempt to sweep through and destroy us who were blocking his way. The heavy ships in support were intended to prevent that, or else to bring on a fleet engagement. In these ways our sensitive squadron would serve a double purpose, either one of which would help end the war—but possibly also ourselves.

However, all that did not worry us. "Stick to your job and go up with it," was the prevailing spirit. The work was too interesting, steady and arduous for uneasy thoughts. The "San Francisco" and "Baltimore," old hands at mining, set a high standard and fast pace, which every man was keen for his ship to equal; and it was well understood by all hands that only the best efforts of every soul could make the kind of team work—throughout each ship and by all ships together—needed to produce the success promised in their name.

To maintain a careful habit among the men, without making them jumpy or fearful, the absolute necessity for *sustained* attention was emphasized, the same care being needed with the 800th mine as with the first or the fifty-first. And to prevent over-confidence growing with familiarity, unremitting pains were exercised to note and follow up all irregularities and apparent slackness—not to find fault, but to keep things taut everywhere, and carry each excursion through with better than railroad precision.

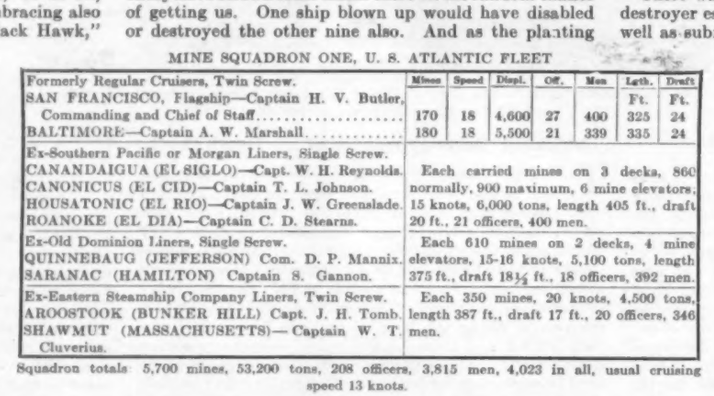
The start of mine planting was always preceded by a busy half-hour. Accurate determination of the position of the field—necessary to know in running the next excursion close by, and also for sweeping up after the war—depended on steady speed and steering, with a minimum of changing courses after leaving the nearest fixed mark. There could be no hesitation nor trial moves. The squadron would approach, take a preliminary formation, turn ships together into a line abreast, stretching sometimes a mile and three-quarters. Then after a brief steadying interval, down would go the planting signal, and overboard the first mine from each ship.

Since all 10 ships abreast would widen the field unnecessarily, the mining would begin with only eight abreast, two in another line 500 yards ahead. When places directly

MINE SQUADRON ONE, U. S. ATLANTIC FLEET

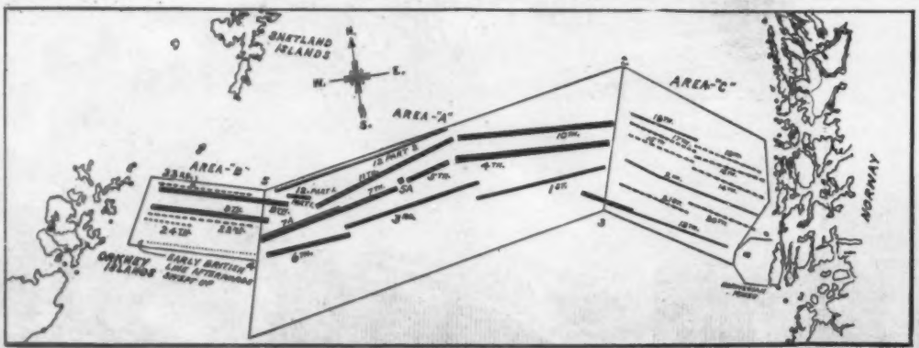
Formerly Regular Cruisers, Twin Screw.	Mines	Speed	Displ.	Off.	Men	Lgth.	Draft
						Ft.	Ft.
SAN FRANCISCO, Flagship—Captain H. V. Butler, Commanding and Chief of Staff	170	18	4,600	27	400	325	24
BALTIMORE—Captain A. W. Marshall	180	18	5,500	21	339	335	24
Ex-Southern Pacific or Morgan Liners, Single Screw.							
CANANDAIGUA (EL SIGLO)—Capt. W. H. Reynolds. CANONICUS (EL CID)—Captain T. L. Johnson. HOUSATONIC (EL RIO)—Captain J. W. Greenslade. ROANOKE (EL DIA)—Captain C. D. Stearns.	Each carried mines on 3 decks, 860 normally, 900 maximum, 6 mine elevators, 15 knots, 6,000 tons, length 405 ft., draft 20 ft., 21 officers, 400 men.						
Ex-Old Dominion Liners, Single Screw.							
QUINNEBAUG (JEFFERSON) Com. D. P. Mannix. SARANAC (HAMILTON) Captain S. Gannon.	Each 610 mines on 2 decks, 4 mine elevators, 15-16 knots, 5,100 tons, length 375 ft., draft 18½ ft., 18 officers, 392 men.						
Ex-Eastern Steamship Company Liners, Twin Screw.							
AROOSTOOK (BUNKER HILL) Capt. J. H. Tomb. SHAWMUT (MASSACHUSETTS)—Captain W. T. Cluverius.	Each 350 mines, 20 knots, 4,500 tons, length 387 ft., draft 17 ft., 20 officers, 346 men.						

Squadron totals 5,700 mines, 53,200 tons, 208 officers, 3,815 men, 4,023 in all, usual cruising speed 13 knots.



Field planted by six ships, abreast, 13½ knots, dropping mines every 11½ seconds

When one ship finished, her successor would take on immediately. At the left end, squadron wheeled to right, first planting marker buoys by which to prolong the field on a later occasion.



The heavy black lines represent fields of mines laid by U. S. minelayers

The lighter lines were laid by British minelayers. Excursions 1 and 12, part 2, are of 3 lines. Excursion 2 is of 2 lines. Four to 7 have 5 lines; 8 and 9 have 6 lines; 10, 11, 12, part 1, have 5 lines; 13 begins with 6 lines, then 2 lines. All British fields are of 2 lines, except those adjacent to U. S. 8th and 9th, where they are in a single line.

astern of them were vacated, these two would ease back into the main line, their predecessors speeding ahead. Ample time was allowed to do this slowly, before their turn came to plant, so as to avoid any extra demand on the engines, which might follow, if a ship dropped back too fast. The steadiest steaming and steering was the rule throughout the mine planting, to minimize possible causes of casualty. The ships were neither new nor decrepit, but we took no unnecessary chances of spoiling a good performance by the squadron as a whole.

U. S. mining ships in line abreast; in the offing the British ships in column

When all mines were out of one ship, her line was prolonged by a parallel begun at the same instant by her prescribed successor. Mines were dropped every 300 feet, in lines 500 yards apart, the nearest distance the minelayers could safely steam abreast. The schedule arranged to narrow the minefield towards the finish, both for compactness and for a greater margin of safety in running the next excursion parallel and close to, when there might be a beam wind or unusual current, setting towards the former field. Taken altogether, minelaying is not too simple an art.

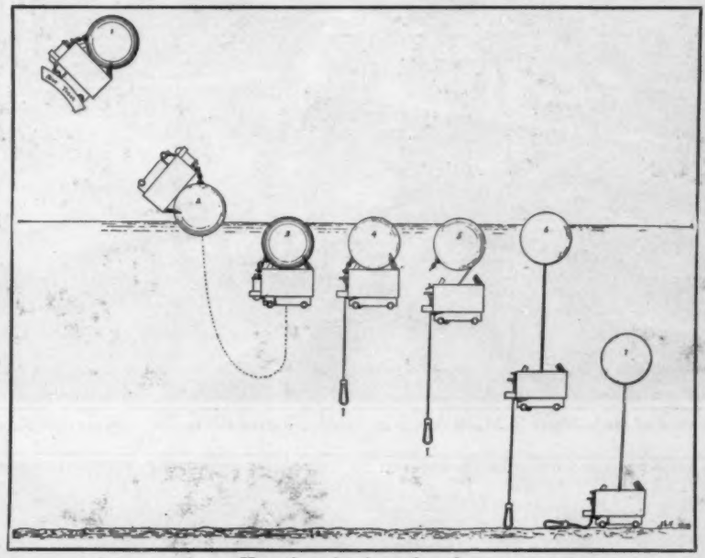
When it finished planting, the squadron had made a trace like a music score, 50 or so miles long. A mile beyond the end, several mark buoys were dropped, for use to "butt" instead of "lap" the next excursion; then back to the base. The men would clean up the decks, secure the mining gear, get a wash for themselves, and enjoy a smoke below—forbidden while mines were on board, and those who could, would sleep. Moving the 400 to 500-ton masses of mines, in slow but steady time, was very fatiguing, even with winches to help, on top of the many other duties common to all ships.

Theoretically, the mines in adjacent lines should be staggered, so as to halve and block each other's intervals, but in an open sea minefield of immense area, 25 miles wide, with no guide marks whatever, no such nicety is possible or necessary. The great Northern Mine Barrage opposed from six to ten lines of mines to submarines on the surface, and three or four lines more at whatever depth the submarine might think he could safely pass. Absolute impassability there never was. A submarine had more chances of missing than of hitting a mine in one line, but not so for *all* lines—and one touch was enough.

Before the first system of the barrier was half way across, reports of damage to the enemy began to come in. This was in early July, and before October 10 submarines had been destroyed in the barrier and probably many more. From the very circumstances in that vicinity, the actual toll may never be known. The latest report is that the Germans admit 23 lost there, and other authorities ascribe the fleet's surrender and the final armistice largely to the defeat of the submarine campaign, which the Northern Mine Barrage forced the enemy to accept.

And with due allowance for the poet's license, perhaps the claim may not be thought too extravagant, in the Mine Force song:

"That force of mine has done its share,
We fixed the U-boat everywhere,
When Vict'ry comes they'll all declare,
That mines have won the war."

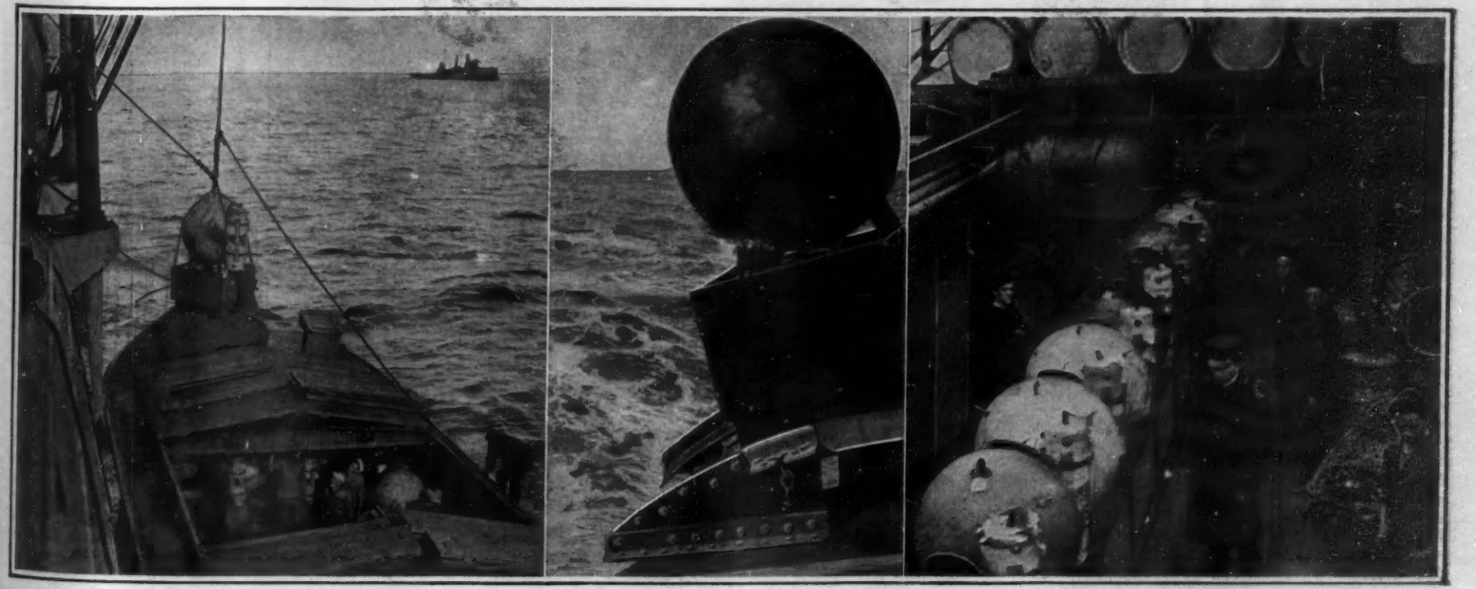


How the mine is anchored

When mine and anchor reach the water, plummet drops, tripping slip hook, which holds mine and anchor together, and lifting the pawl of the mooring-cable reel. The plummet cord is made the same length that it is desired to have the mine beneath the surface. The plummet, being solid metal, sinks faster than the bulky anchor, thus keeping the cord taut; but when the plummet strikes bottom, the cord slackens, releasing the pawl, which locks the reel. The anchor, continuing to sink, draws the mine down, until the anchor strikes bottom.

A New Surgical Method

A VERY important progress in surgery is announced in France, which consists in the discovery of a method of performing any surgical operation without pain. On this new method, the principle is to make the patient insensible to pain, but he does not lose consciousness. It is based on a principle which was brought out several years ago, and this allowed of making operations on the lower limbs and the lower part of the body without pain, by injections of cocaine or similar substance into the spinal column. But this treatment did not produce insensibility in the upper part of the body. Within a recent period Dr. Le Fillatre succeeded in making the entire body insensible by the use of a single injection, and the liquid comes in contact with the spinal column throughout its whole extent. He makes use of an injection needle and a glass syringe. After purgation the day before and also half an hour before the operation, he makes the injection of the liquid, which is cocaine or other substances such as sulfate of strychnine and sparteine. The patient has his eyes bound so as not to be affected by external movement, and he sits on a table with his legs stretched out before him. The application is made at the lower end of the spinal column, and upon making a puncture, the liquid surrounding the spinal column flows out. When a sufficient amount has flowed, depending on the degree of insensibility which it is desired to produce, he applies the syringe with the cocaine or other solution and pushes in the contents. This action is repeated several times, and the operator obtains a properly regulated mixture of cocaine and the spinal fluid. The insensibility of the lower part of the body is almost instantaneous; in the trunk and in the arms and head it follows a few moments after. Then the patient is in a condition to undergo almost any kind of surgical operation, and without pain, but he remains conscious.



Hoisting the mines from the barge to the minelaying ship

A mine going overboard from the stern of a minelayer

Train of mines being hauled along by winch. Overhead, a marker buoy

New York's Aeronautical Exposition

Observations at the Exposition and Some of the Conclusions Which May Be Drawn with Regard to Military and Commercial Aviation

THE airplane of war and the airplane of peace stand unveiled at last. For several years back, and all during the four and a half years of frightful slaughter and devastation in Europe, the airplane has been more or less a guarded secret. True, accounts have come back to civilians regarding the relative characteristics and merits of the leading enemy and Allied craft, and even photographs have been permitted to reach the press. But all such accounts and photographs have dealt with antiquated machines—antiquated in the military sense, which means a type that has been in use at the front for some months and that has fallen into the hands of the enemy, with its wealth of innovations and secrets. And then the best of accounts and the most interesting of photographs have often told but a small part of the entire story. For after all is said and done, there is nothing like viewing the described articles at first hand.

To climb into an American DeHavilland battleplane; to aim the twin machine guns aboard a bombing plane; to toy with the so-called camera gun, used in training aerial marksmen; to study a French Spad and Nieuport at close range; to peer into the cockpit of a British S. E.-5 Scout; to stand beneath the wings of the giant Handley-Page; to see at a glance the leading airplanes of the world—all these things and many more were the privilege of the visitor to the New York Aeronautical Exposition, held during March 1st to 15th in the Madison Square Garden and the 69th Regiment Armory. The visitor had an opportunity of seeing for himself what others had seen and photographed and described for him during the past few years. And he had the opportunity of seeing what had never been described, particularly in the way of planes for civilian use.

In the matter of military planes, it appears from the massed exhibits that the designs have become more or less standardized as the result of years of competitive effort, although during the last six months of war the Allied and particularly the American designers were beginning to question the efficiency of accepted constructions and were delving into strange fields. Most of the scout machines—single seaters intended for combat work—either followed the general lines of the French Spad or the "fish" shaped planes of the Germans. When it came to engines, machine-gun equipment, fittings, and other details, however, there seems to have been a wide divergence of ideas. But all scout plane designers agreed on the cutting down of "parasites," which means unnecessary guy wires, landing gear parts, engine housings, and other surfaces offering considerabe head resistance, and religiously applied the stream-lining which Edouard Nieuport first introduced in the monoplane bearing his name.

In two-seater battleplanes and general utility planes, the divergence in designs is pronounced. Yet the general design and equipment of a veteran DeHavilland-Four American plane, which was exhibited to thousands of curious visitors, may be taken as a good example of that class of fighting machine. With two synchronized machine guns forward and twin machine guns on a scarf mounting at the rear, this machine was able to give a very good account of itself in the closing days of the war.

As for large planes, the leading Allied and American types were well represented. An American-built Handley-Page and a Caproni triplane, and the all-American Glenn Martin bomber, were on hand. In fact, like nothing else these planes, which, by the way, are by no means the largest in the world, served to convince the layman of the immediate commercial possibilities of the airplane.

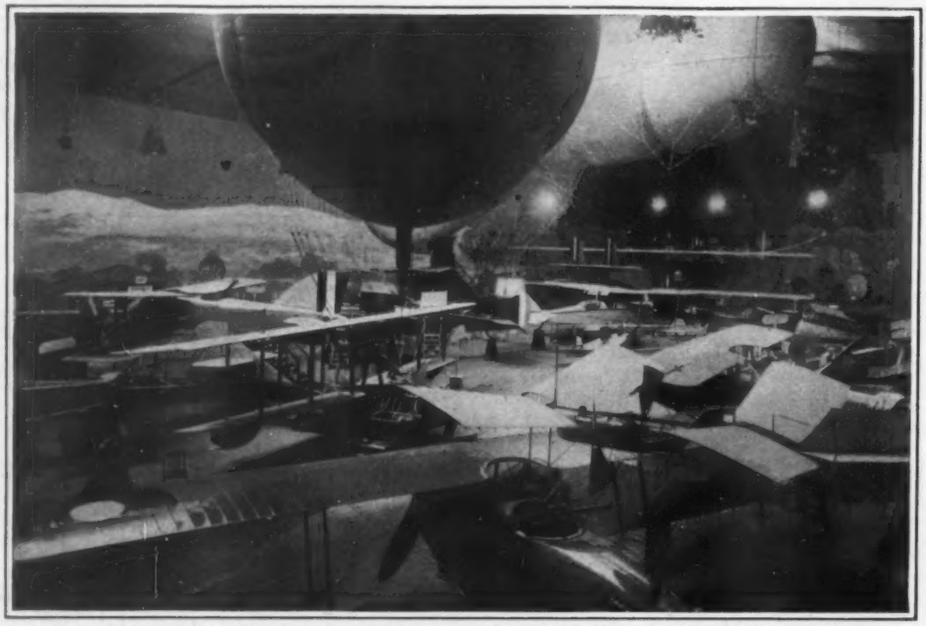
Perhaps the most interesting exhibit of the entire Exposition from a connoisseur's point of view, was the Loening monoplane, developed by an American engineer during the closing days of the war and a little too late to serve at the front. The Loening monoplane is equipped with a Hispano-Suiza engine of 300-horse-power rating. Its monoplane wings are supported by four sturdy spars running at a slant from the underneath side of the wings to the fuselage. Two seats are provided, one for the pilot and one for the observer. Complete and loaded, the monoplane weighs 2,600 pounds. It has a speed of 145 miles an hour and a "ceiling" of 25,000 feet, carrying sufficient fuel for three hours. Despite its rather unorthodox design, this very remarkable machine has established enviable records among military planes; and had it not been for the signing of the armistice, the Loening monoplane would have established still more startling records over the battlefield.

If anything, the Christmas "Bullet" of biplane design is still farther removed from accepted practice. This machine, equipped with a Hall-Scott 210 horse-power engine, is a single-seater, weighs 2,100 pounds with its load, and has flexible wings. Its upper plane is 28 feet wide, while the lower one is about one-half of that. There is a complete absence of struts between planes, there being a combination wood and steel cantilever structure running throughout the planes to give the necessary support. By casting aside all usual means of bracing the wings, the designer has certainly gained tremendous speed with a comparatively small horse-power; but it remains to be seen whether this does not entail too great a sacrifice of structural strength.

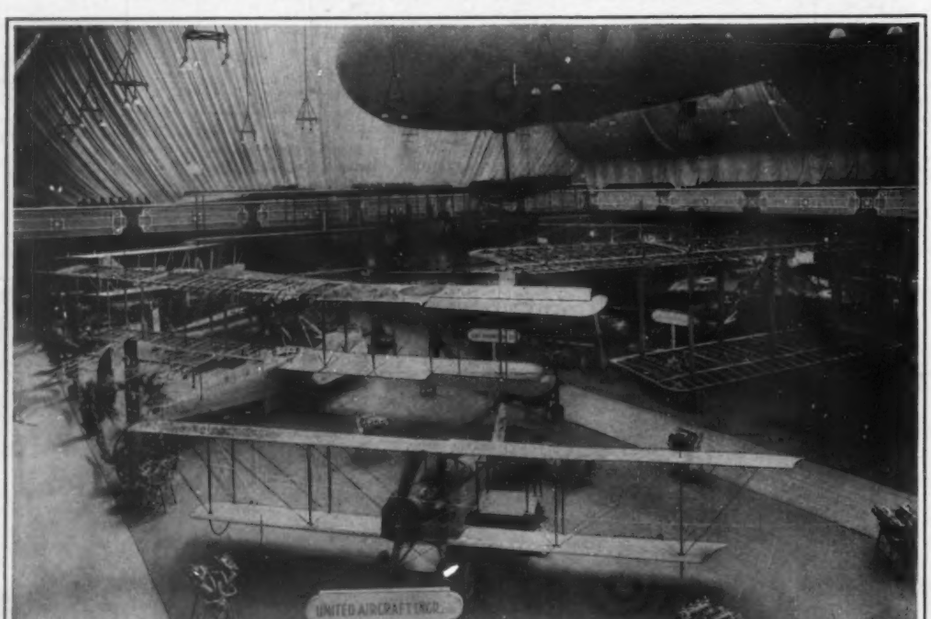
The Gallaudet D-4 bomber is a seaplane of interesting design because, while it has but one engine and a long fuselage member, it employs a propeller instead of tractor or "pulling" air screw. This is accomplished by having the Liberty engine drive the "pushing" propeller attached to a ring surrounding the fuselage, at the rear of the occupants. In official tests the Gallaudet seaplane has proved quite remarkable, with a high speed of 126 miles an hour, a slow speed of 42.6 miles an hour, a slowest getaway of 46 miles an hour, and a two-minute climb of 2,100 feet. All of which goes to prove that the Gallaudet design is quite correct.

One more word with regard to the matter of speed. There are several claimants to the title of "the fastest machine in the world." One of these is the Christmas "Bullet" which claims a speed of over 180 miles an hour. Another is the Thomas Morse MB-3 biplane, equipped with a 300-horse-power Hispano-Suiza engine, which weighs 2,000 pounds loaded with its single passenger and claims 163 miles an hour. Still another is the Curtiss 18-B biplane, equipped with the Curtiss engine and weighing 2,900 pounds fully loaded, and for which 163 miles an hour is claimed. With the exception of the Curtiss, which

(Continued on page 306)



General view of the exhibits in Madison Square Garden during the recent Aeronautical Exposition



General view of the well-arranged exhibits in the 69th Regiment Armory

The Wireless Compass

Piloting Ships Into Port by Radio

By Jerome Lachenbruch, Radio Electrician, U. S. N. R. F.

A COIL of wire, a dial registering 360 degrees, a hollow steel shaft, and an automobile steering wheel have overcome the terrors of fog and storm to mariners approaching port. These few pieces of apparatus comprise the essential parts of the radio compass, an instrument whereby the bearing of any ship on a shore station may be ascertained with speed and accuracy. Through the stimulation of necessity, the radio compass or direction finder, as it is sometimes called, has been in constant operation on naval shore stations during the war. Its value has been proved by service, but publication of its efficiency has heretofore been prohibited.

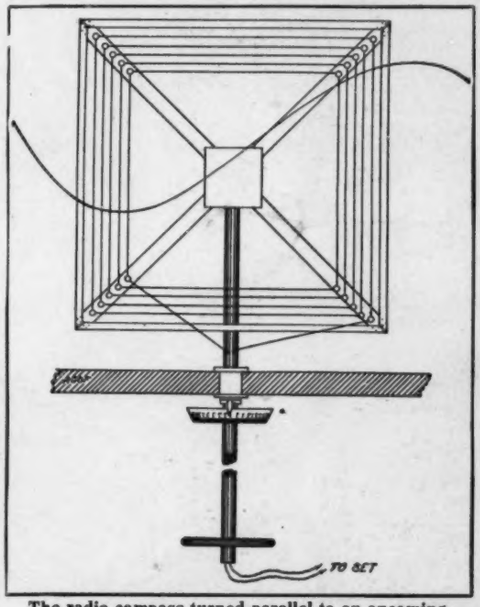
With the coming of peace, the attitude of absolute secrecy maintained by the Navy Department in regard to the many inventions perfected by this branch of the military establishment, has relaxed; and the scientific means whereby the men of the navy helped to protect our ports, may now be disclosed. The radio compass, which has served us in time of war, is now interpreting the needs of peace.

It is not generally known that wireless operators are on watch every second of the day at various naval shore stations in the vicinity of New York; nor that, during the war, operators timed the length of, as well as the interval between dots and dashes whose characteristics aroused suspicion, all the while manipulating the wheel of the radio compass to obtain a direction on the sending station. This exhausting work proved to be of valuable assistance in locating enemy wireless stations that persisted in the surreptitious use of radio despite the government's war order restricting the activities of all but government radio stations.

In construction, the radio compass differs from the usual radio receiving set mainly in the type of antennae used. The familiar sight of several strands of wire stretched at considerable length between high masts is absent. In place of the stationary, space-consuming aerial, is a rotating five-foot frame with a few turns of stranded copper-bronze wire wound about it. The frame is mounted on a vertical steel shaft which projects downward through the roof of the radio building into the room where the operator is on watch. In many stations, a cupola has been built about the frame with the double purpose of affording protection against the elements and of concealing its presence. At the base of the shaft, and within easy reach of the operator, the wheel which controls the turning of the frame is attached. The compass dial, usually a circular aluminum band, with the 360 degrees of the compass clearly engraved on its surface, is fastened to the shaft near the roof of the radio "shack"; but the indicator is placed in a permanent north and south direction. Two "leads" from the frame form the electrical path between the antennae and the receiving set.

In conjunction with the receiver, an oscillating audion and an amplifier are usually employed thereby magnifying the strength of incoming signals about eight times their normal degree of audibility.

The theory on which this unique construction of the radio compass operates involves several characteristics of the electro-magnetic wave. If a pure sine wave (which is never met with in practice because of the distorting influence of objects in and around the radio room), is assumed, three phenomena of electricity combine to give the results observed in the radio compass. They are the resisting or "bucking" action of induced currents, and the differences in amplitude and in phase of an electro-magnetic wave at different intervals of time. In the accompanying diagram, the plane of the radio compass is shown parallel to the oncoming wave which strikes both sides of the wired frame at different phases and at different amplitudes. Two electric currents are induced in the antenna, the one when the magnetic wave comes in contact with the nearer side of the arial, the other when it reaches the farther side. These induced currents will be in the same direction, and consequently will tend to "buck" or counteract each other. But, due to the differences in

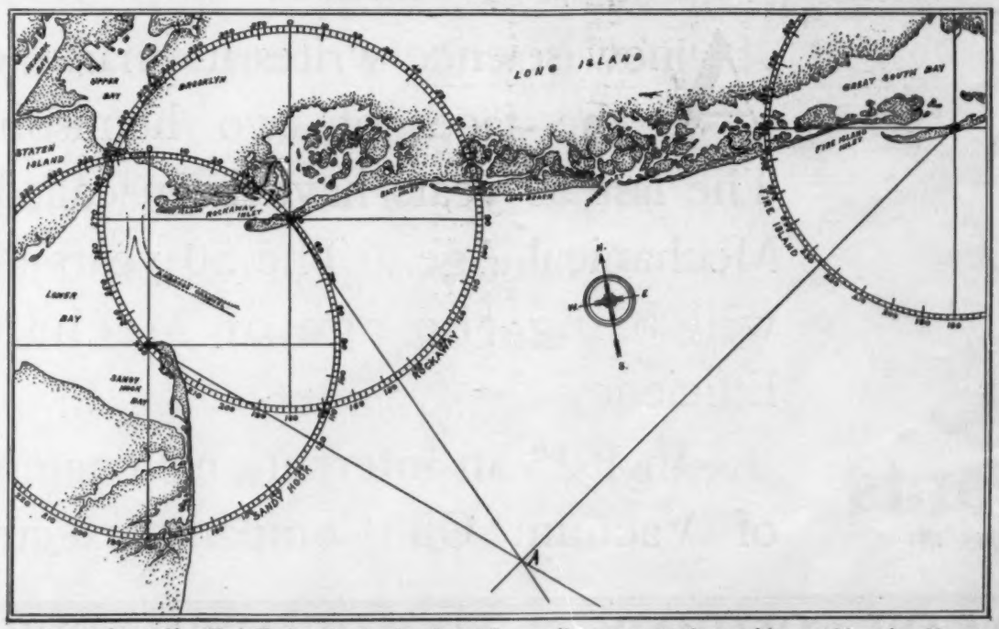


The radio compass turned parallel to an oncoming electro-magnetic wave

amplitude and in phase of the magnetic wave at the two points of contact, the induced currents will be of different strengths; and, although the one tends to obliterate the other, the difference in strength between them is conserved and heard in the telephones. However, if an incoming electro-magnetic wave strikes the plane of the antenna perpendicularly, the currents induced in both sides of the compass will be equal in strength, of the same phase and amplitude, and will neutralize each other. No sound is then heard in the telephones. By means of the rotating antennae, the angle at which an electro-magnetic wave acts on it can be controlled by the operator. Thus the intensity of an oncoming signal can be increased, diminished or completely tuned out by a turn of the wheel. It is evident, then, that when the plane of the antennae is parallel to the direction of the oncoming wave, the sound heard in the phones will represent the maximum strength of the oncoming wave. By turning the antennae until this point is found, the maximum strength of any signal can be ascertained; and consequently, the position of the ship or shore station sending it will be disclosed. But to be more accurate, two positions are made known, 180 degrees apart. By consulting the diagram, the reason for this is apparent. It will be observed that two waves coming from opposite directions will affect the radio compass in the same manner.

In actual practice, however, a shore station operator knows that the coast line limits the arc of the compass in which he may expect to locate a ship. Moreover, to secure the best possible results in the every-day operation of the radio compass in guiding vessels into the port of New York, five radio compass stations have been established at strategic nautical points on the coast near New York. Each station is connected by a land line telegraph instrument with a central controlling radio station located in the office of the District Communication Superintendent, at 44 Whitehall St. This station has been brought to a state of high efficiency by Lieut-Commander R. B. Coffman and Lieut. M. W. Arps who is in direct charge of the control station.

The close connection between the compass stations and the control station simplifies the details of communication with vessels at sea. Within a few minutes a ship may receive definite information as to its position. When a ship approaches the 50 or 100-mile coast line, the operator aboard calls New York and asks for his bearing. The ship does not get into direct communication with the various compass stations as they are equipped only with receiving sets, and so cannot reply. However, the radio operator at the central controlling station, in answering the ship's call, transmits a signal to the ship to send its call letters for 30 seconds. At the same time, a telegraph operator at the control station notifies the various compass stations, by means of a three-letter signal sent simultaneously, to obtain a bearing on the ship sending her call letters. Immediately the various stations in the district, at Montauk Point, L. I., Fire Island, L. I., Rockaway Beach, L. I., Sandy Hook, N. J. and Mantoloking, N. J., turn their compass wheels until an accurate bearing is obtained at each station. This is transmitted to the telegraph operator at the control station, who waits until all stations have sent their bearings before turning them over to the radio operator. The latter, when all the compass stations have been heard from, flashes by radio the bearing, in degrees, of the ship on the different shore stations. An acknowledgment from the ship of the receipt of the desired information completes the operation.



Approaches to New York Harbor showing location of three radio compass stations and how position of a ship sending signals from A may be determined

The accuracy of the bearing reported by each compass station is determined at the control station by consulting a map of the coast which is arranged with an ingenious device for the particular purpose it serves. The map, spread out on a large table, is covered with glass. Holes are punctured through the glass at the center of the large circles drawn about the various compass stations as centers. The circumferences of the circles are divided into degrees. Threads

(Continued on page 306)

Flags indicate 18 refineries and works producing Gargoyle Lubricants

A new science writes its mark across the faces of two hemispheres. The last 50 years have been called the Mechanical Age. The 50 years ahead will bring the age of Mechanical Efficiency.

In 1913 an international conference of Vacuum Oil Company executives

GARGOYLE

Lubricants

A grade for each type of service

VACUUM OIL COMPANY *Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world* NEW YORK, U.S.A.

Pins indicate some of the more important of the 250 ports where Gargoyle Lubricants are stocked

and engineers from 14 countries finalized the lubrication ideal—the right oil in the right place in the right way.

Lubrication as developed by the Vacuum Oil Company became a science which has opened the way to a new mechanical efficiency for the age ahead.

The work must go on.

GARGOYLE

Lubricants

A grade for each type of service

VACUUM OIL COMPANY *Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world* **NEW YORK, U.S.A.**

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

The Good-Sense School Desk

WHY is a schoolboy round-shouldered? Why does a schoolgirl get a flat chest and a squint that indicates eye-strain? Mr. Frank Foster of Seattle says that the answer to these questions is to be found in the poorly designed desks before which the youth of the land is forced to put in many hours each day; and he has invented a desk which embodies his ideas as to how this abuse should be remedied.

The good old-fashioned school desk is flat, or nearly flat; and it is rigid. No matter what the angle of the light, no matter how obvious it be that the book should be supported at an angle approaching the vertical, the student has but two choices—he must support the book in the right position in his arms, entirely by his own effort, or he must lay it down flat and make shift to read it in that position as best he can. Either alternative imposes undue strain upon him. Our first photograph is a typical one; go into any school house in the land and you will see hundreds of subjects who might have posed as originals for it. Does this coming citizen look happy and comfortable? He does not, because he is not.

The inventor has met the condition outlined by a desk with a top that is broken across near the back, as seen most clearly in the desk behind the seated student, in our second picture. The book-rest thus afforded is completely adjustable, alike with regard to distance from the eye, and angle. It is no longer necessary for the student to go through a process of contortion to get the proper focus on his work; he simply adjusts his desk until he has it. A final touch is the rail at the bottom that prevents the book from sliding off. The rail may be slid to the back of the desk, out of the way, when it is desired to use the surface of the desk for writing, thus making the desk adaptable to all requirements.

The wrong way to sit—hunched over a flat, rigid desk

The right way—a comfortable seat before a flexible, tipping desk

Practising Dentistry on a Model

By Ruth Stewart

INSTRUCTION of student dentists at the State University of Iowa has been facilitated by means of an operative technic unit, designed by Dr. R. H. Volland, professor of operative pathology and technology.

The unit is equipped with air, gas, and electricity, and is supplied with a dummy jaw upon which the novices may practice. It is adjustable to all positions which might be taken by a patient. Necessary instruments may be placed upon a shelf attached to the implement. Methods of making all kinds of repairs and the placing of false teeth are demonstrated by means of this unit.

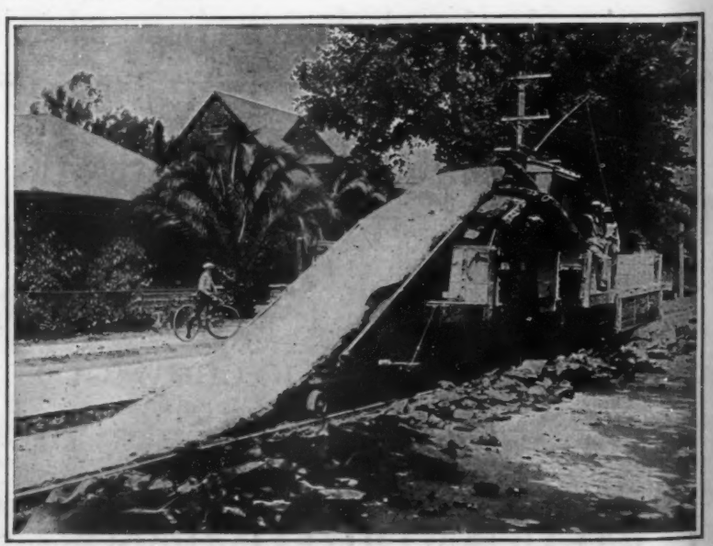
A dummy jaw upon which the dental novice may practice

Removing Old Pavement

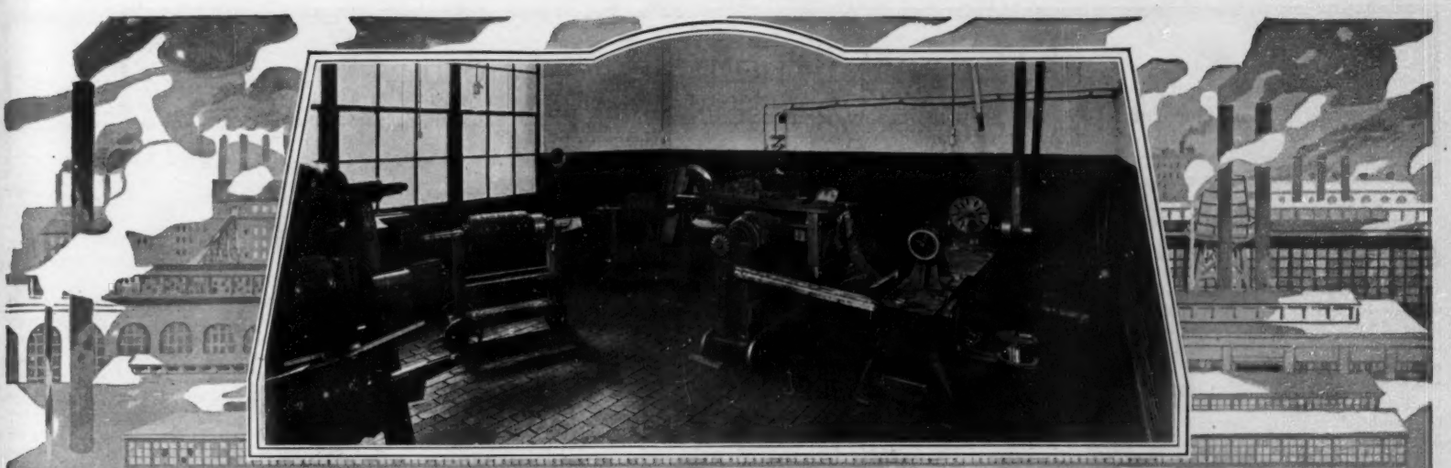
THE tearing up of an old asphalt pavement has always been a tedious job, and especially between car tracks. A special machine is in use by the United Railroad of San Francisco which does this work in a very short time, not only tearing it up, but loading it into a work car in one operation. Any work car can be used. On the front of this a 75-pound T-rail frame couples and this supports a scoop or shovel having a sharp turned-up edge at the front. It measures 34 inches wide and 63 inches long. From the shovel an inclined platform extends to the loading car. This platform measures 4 feet wide by 15 feet long and has sides to guide the sheet of asphalt. When in operation the point of the scoop is forced under the asphalt to start it, then the rest is accomplished by moving the car ahead slowly, the narrow sheet of asphalt between the tracks is raised up the incline and over the edge of the platform into the body of the car. This is continued until that end of the car is filled, then the car is turned around and the same process is continued.

This is a labor saver, time saver and money saver.

The apparatus that tears up asphalt pavement and loads it on a flat car in a single operation



A strip of pavement between the tracks being torn up and carried away in record time



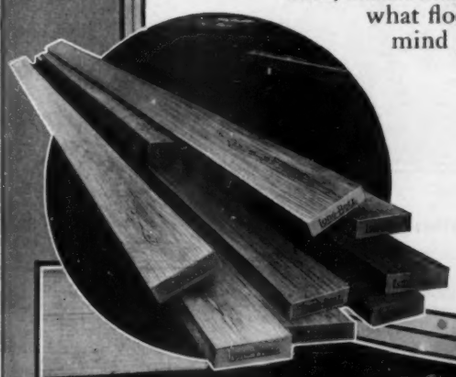
A Lumber Trade-Mark That Stands for *Quality!*

THE largest manufacturer of Southern Pine in the United States, The Long-Bell Lumber Company, now trade-marks all its lumber products. That mark does more than identify the manufacturer, it means that our reputation is back of it—a reputation for producing quality lumber products for a quarter of a century. Look for this trade-mark:

LONG-BELL

THE MARK ON QUALITY LUMBER

L-B Creosoted Southern Pine Flooring Blocks, one of our products, make modern, perfect industrial floors. They are most durable, economical and safe. No matter what flooring job you have in mind you should investigate the facts pertaining to L-B Creosoted Southern Pine Blocks. The **LONG-BELL** hydraulic-pressure-vacuum process impregnates with creosote the entire sapwood of each block. Send for free booklet on our creosoted products.

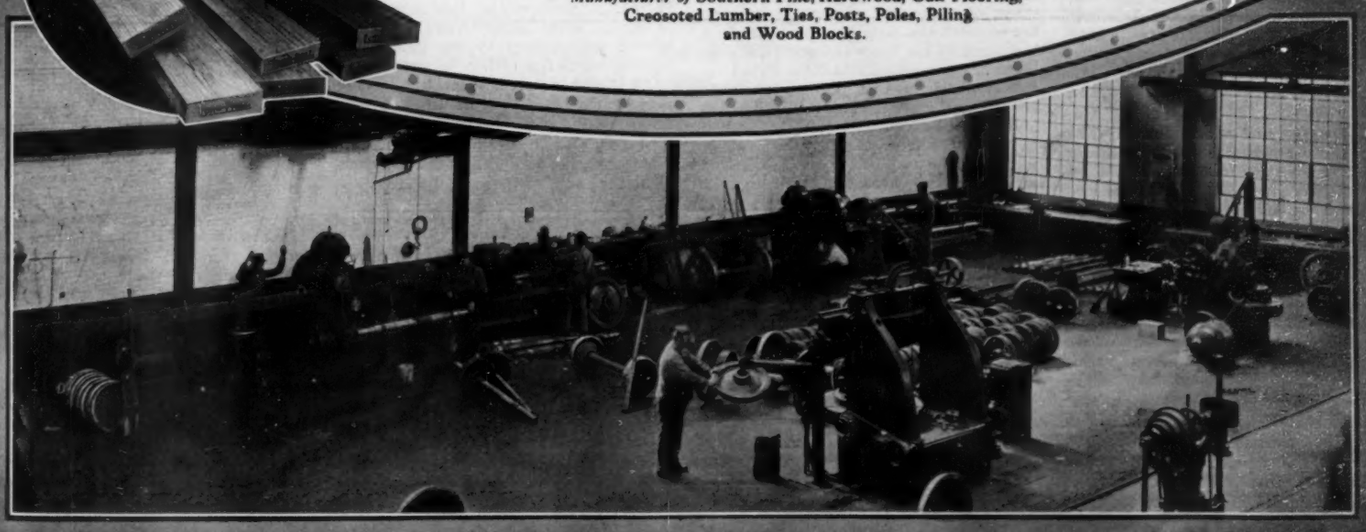


Specify and ask your dealer for **LONG-BELL** brand.

The Long-Bell Lumber Company

R. A. LONG BUILDING KANSAS CITY, MO.

Manufacturer of Southern Pine, Hardwood, Oak Flooring; Creosoted Lumber, Ties, Posts, Poles, Piling and Wood Blocks.



Reconstruction Department

A Department Devoted to the Improvement of Old and Development of New Lines of Manufacture

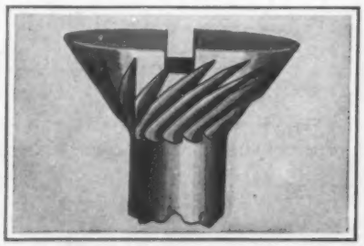
The Editor is anxious to help manufacturers who have idle machinery on their hands during this reconstruction period, and who are looking for new articles suitable for them to manufacture. He solicits letters from manufacturers, stating the line of work adapted to their machinery, and from inventors, stating clearly the nature of the devices they have to offer. Inventors are requested to send complete information about their inventions, with working drawings and photographs of models; but models should not be sent as we are not equipped to handle them. The Editor will forward this material to manufacturers who are interested. This service is performed without charge.

Suggestions for Manufacturers

QUANTITIES of letters have come to the office of the Reconstruction Editor in response to the manufacturers' appeals for suggestions published in the issue of February 15th, and the majority of these have been forwarded to the manufacturers designated, but in many cases inventors have given no hint as to which particular letter they wished to send their suggestions to. There have been many requests for addresses of these manufacturers and we must repeat that these addresses are held in confidence and cannot be given to inventors. The Reconstruction Editor acts merely as a forwarding agent and will send on communications addressed in his care. This work is done without charge either to the manufacturer or to the inventor. It is a voluntary service offered as an aid to the reconstruction of our industries and to promote progress.

Among the suggestions contributed there are many that do not fit the requirements of any of the manufacturers who have written the Editor so far. They range from a scheme for teaching music, to a hot water bag in the form of a doll, which is calculated to appeal to infant invalids. Some inventions that are interesting and apparently practical are illustrated herewith in the hope that they may appeal to some manufacturer who has not yet written to the Editor. They also give some idea of the variety of inventions that have been offered.

Countersinking screw head.—Instead of using a special tool to countersink a screw hole for a flat head wood screw, an inventor has formed the head with flutes so that it will do its own countersinking. It will also exert a continuously increasing tightening action as the screw head is driven into the wood.



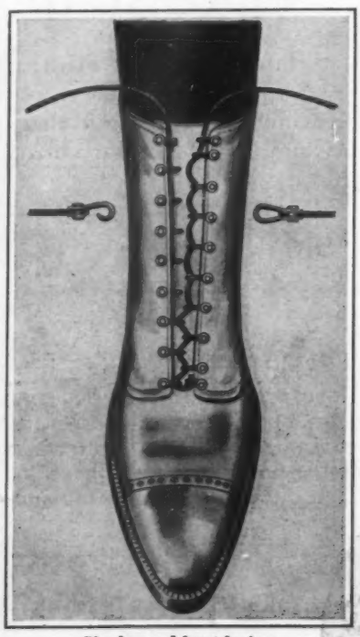
Self countersinking screw-head

Deglutitory cup.—An invention of very different character is one adapted for the sick room. It is an arrangement whereby it is possible to swallow medicines without experiencing any disagreeable taste. A small cup is provided which is held in a wire clip that may be attached to the rim of a tumbler in the manner shown in the accompanying illustration. The tumbler is first partly filled with water and then the cup with the medicine in it is fitted to the tumbler. The patient merely drinks the water in the glass and at the same time the medicine flows out and, floating on the film of water, is kept from coming into contact with the tongue. Not only liquid medicines, but capsules, pills and powders can be taken in this way.

For taking disagreeable medicines

Hog holder and stock chute.—The Editor has received many inventions pertaining to the farm, but as yet no manufacturer has called for suggestions that belong in this class. Here is a device that should appeal to the farmer and stock man. It is a chute for loading hogs into wagons for market and also a holder for full grown hogs at ringing time. The device is in the form of crate into which the hog is driven. At one end there is a gate with a wide notch in the bottom which closes down over the neck of the hog as shown clearly in Fig. 2. In this position the gate is locked and the ringing operation may be performed with ease. Fig. 3 shows the crate tilted up on a pair of folding legs so that the stock can be driven into a wagon or truck of standard height. A section of the floor may be folded up to prevent the animal from backing out. Fig. 4 shows how the chute may be folded up when not in use.

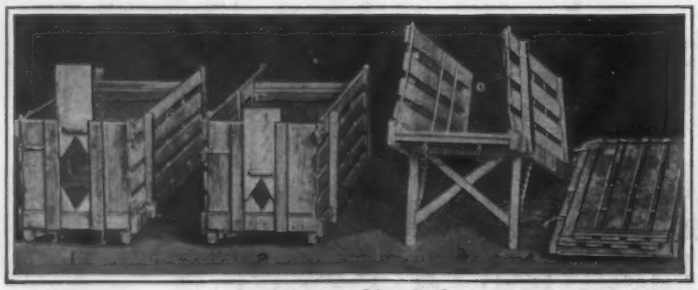
A novel shoe lacing.—The process of threading a shoe lace through eyelets is tedious to say the least. The ordinary hooks save much time, but they are apt to catch in the clothing. This is particularly true of women's wear. To remedy this defect an inventor has patented a new form of boot or shoe lacing. The adjacent edges of the shoe are provided with fastening devices consisting, on one side, of eyes and, on the other, of hooks that are turned in so as not to catch the clothing. The shoe lace is secured at the lower end and passes up through the eyes. To lace the shoe it is merely necessary to slip the hooks over the lace and draw the lace taut. Then it is tied to a bit of lacing cord fastened to the top of the shoe. Lacing and unlacing may be accomplished with extreme rapidity and because the lace runs in a single line from top to bottom the fastening is very flexible and adjusts itself readily to the movements of the foot. As the boot does not ordinarily have to be completely unlaced when it is taken off hooks may be used for only the upper half of the flap. This same form of lacing may be used for other articles such as gloves. In the latter case it is not necessary to tie the end of the lace, It may be secured by means of a clip. The illustration shows how the lace is manipulated.



Single-cord boot lacing

Suggestions for Invention

THE Reconstruction Editor has received some suggestions which are offered gratuitously to the public, the correspondent not caring to develop his ideas in any concrete form, but leaving that for the inventors to do. Such were the suggestions published in our issue of January under the heading, "A Safe for Liberty Bonds." Through an oversight the name of the correspondent was omitted. We take this opportunity of announcing that it was Mr. A. H. Berwald, of Wilmington, Delaware, who furnished the suggestions.



Stock chute and hog-holder

The following letter has been received from Mr. A. E. Jackson of Toronto, Canada, who suggests some long-needed improvements in the meat-packing industry:

"The requests that have been made through your columns that articles for manufacture in over-equipped plants, be submitted, leads me to suggest two very real necessities which would find large sales in the packing houses. Having had 14 years' experience in the packing industry, I have been in a position to observe present methods of handling meats and their by-products, and am positive that these articles would meet with favor.

"The first is a traveller for beef rails equipped with a clutch instead of the crude hook now in use. I have seen hours of valuable time wasted in removing these hooks from frozen beef, it taking two and sometimes four men to handle one-quarter or side of beef from the rail without accident. By the use of a clutch hanger, the beef could be released by the man who must carry it, by merely raising it on his shoulder 3 to 6 inches above its normal position.

"My second suggestion is an automatic cleaver for sectioning sides of hogs. This work has always been done by hand except where the band or circular saw is used. The saws are not satisfactory, however, as they draw the bone dust and marrow into the meat. With a mechanical cleaver it would be possible to get a straight clean cut in exactly the spot where it is required, with one stroke, leaving the operator's hands free to feed it.

"The cleaver should be made to remain in an upright position when the stroke is finished, in other words the action should be down and then up, instead of up and then down as is the case with automatic hammers.

"It would naturally take a very powerful stroke to sever the ribs in dividing the side from the back of a heavy hog, but by using a weighted cleaver with powerful springs drawn up by a system of gears, and released by a trip arranged in connection with a foot lever, it should be possible to make one stroke to finish each cut."

Wanted: a Manufacturer for an Improved Table

THE Editor is in receipt of the following communication and will be glad to forward replies to this letter to the company which is now engaged in manufacturing these tables.

"We have read with interest some of the articles in your reconstruction division, and would say we have a patent table serviceable for either library or dining purposes.

"This table has been on the market about three years and is selling freely. However, we are at a great disadvantage trying to do a National business as the freight rates and distances are considerable against this proposition.

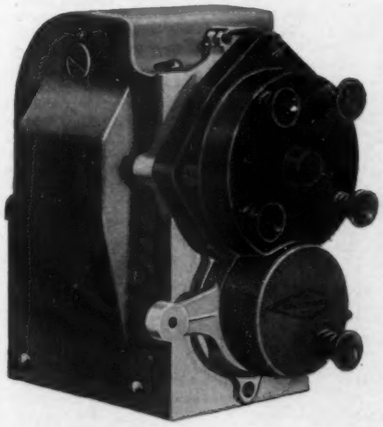
"The table can be made in any first class factory and we are in a position, or would be interested in placing an order for a quantity of these to be manufactured, as we are contemplating a National Campaign."

1 Magneto Don't

In strong contrast to the Battery Don'ts is the one Magneto Don't:

1. Don't Worry

The MAGNETO always does its duty under the most exacting conditions of speed, climate or load on airplanes, passenger cars, trucks, tractors, motorcycles or any other internal combustion engine. And the only attention it requires is two drops of oil every two weeks.



Aero MAGNETO
Dixie MAGNETO

The AERO Magneto was designed and perfected by Splitdorf engineers for the extremely severe service on war airplanes.

It was standard equipment on American airplane engines as well as other airplanes of the U. S. and Allied Governments. And its reliable and efficient performance on these airplane engines and on thousands of heavy transport trucks under actual fighting conditions place it far in the lead of all other ignition systems. The AERO Magneto for passenger cars and trucks offers an ignition system that is without fault.

DIXIE Magnetos and SUMTER Starter Couplings are standard equipment on the majority of tractors and on many trucks of the leading manufacturers, while SUMTER and DIXIE Magnetos are popular equipment on stationary engines.

13 Battery Don'ts

1. Don't forget to put water in your battery every week.
2. Don't use anything but *distilled* water.
3. Don't let the electrolyte spill on top of battery.
4. Don't have an open flame in same room with a charging battery or an open battery.
5. Don't permit battery to stand without a charge.
6. Don't allow sediment to collect in the cells.
7. Don't fail to keep the terminals tight.
8. Don't connect terminals to the wrong poles.
9. Don't let terminals come in contact with battery box.
10. Don't forget to test with a hydrometer at least once a week.
11. Don't let your battery become *over* charged.
12. Don't permit plates to become buckled by lack of water.
13. Don't forget to turn off your ignition and light switches when you stop your engine or your battery may run out.

SPLITDORF

Electrical Co., Newark, N.J.
Sumter Division, 1466 Michigan Ave. Chicago

TRADE SPLITDORF MARK

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Apparel

CAP.—W. W. HOOK, 705 South Hope St., Los Angeles, Cal. The invention relates to caps for general wear, but more especially adapted for ladies' wear. The cap is in the "fore-and-aft" form as worn by the Belgian army, having a lap or brim ordinarily turned up about the body of the cap, but adapted to be lowered over the ears and back of the head. Further objects are to provide a veil detachably secured to the cap, and a goggle flap at the front adapted to be folded upwardly within the cap or lowered to a position for use.

Electrical Devices

ELECTRIC-BELL.—J. F. ROGGERS, Remsen St. near Merrick Road, Jamaica, L. I., N. Y. The object of the invention is to provide an electric bell provided with an arrangement for making and breaking the circuit when the coil is energized thus insuring proper working of the striker core. Another object is to provide but few parts not liable to get out of order, thus simplifying the construction and reducing the cost of manufacture.

Of Interest to Farmers

CORN UNCOVERER.—O. G. OPALKA, Box 12, R. F. D. 5, Cambridge, Ill. The invention relates particularly to agricultural cultivating implements. An object is to provide an attachment for cultivators whereby the small corn plants may be uncovered, the clods destroyed, the weeds uprooted and the hill shaped, as the work of plowing or cultivating progresses.

APPARATUS FOR HANDLING RACKS.—F. J. LOVERING, Octavia, Neb. The object of the invention is to provide a device especially adapted for placing and removing hay racks and wagon bodies from the running gears of wagons, wherein a wheel supported standard is provided having means for lifting the rack one end at a time and placing it on the running gear, the wheels of the rack having means for preventing skidding movement during the lifting of the load.

Of General Interest

FOUNTAIN PEN.—N. R. DENNIS, Box 242, Ensley, Ala. The object of the invention is to provide a fountain pen wherein the discharge of the ink from the reservoir may be nicely controlled to feed any desired amount of ink and wherein the

A SECTION OF THE PEN HOLDING PORTION

feed may be retained constantly. An annular scale is provided adjacent to the point to show the exact opening of the ink valve, after the proper regulation of the flow is obtained, the valve remains in adjusted position to insure the discharge of a constant amount of ink. Ordinary pen points may be used with the device.

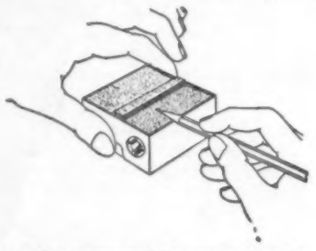
CONCRETE COMPOSITION.—C. E. BARGLEBAUGH, 3401 Tularose St., El Paso, Texas. An object of the invention is to provide a concrete which has great strength in comparison with its weight, or in other words a concrete which is relatively light. A further object is to provide a concrete of a dark color due to the use of crushed rock, and aggregate of volcanic origin known as lava rock, without any addition of coloring matter and without the use of ordinary sand. This concrete is waterproof.

METALLURGICAL PROCESS.—J. T. JONES, 429 Union Arcade Bldg., Pittsburgh, Pa. An object of this invention is to provide a process in which ores containing iron and manganese may be treated economically, and in which the iron, after it has been reduced to the metallic state, may be easily separated from the manganese, and in which the manganese may subsequently be reduced to the metallic state and separated from the slag. The process requires a relatively small amount of coal or other carbonaceous material.

PHOTOMETER.—A. P. LITTLE, 85 Lake St., New Haven, Conn. The invention relates to a photometer employing a surface rendered luminous by a self-luminous material. The device comprises a screen adapted to be illuminated by the light whose intensity is to be measured, a means of varying the intensity of the light falling on the screen, and indicator, a sight tube, a comparison screen, and an inclosure for the screen the surface of said inclosure supporting the self-luminous material.

NEEDLE THREADER.—M. J. WEBB, 8 Royal Terrace, Kingston, Dublin, Ireland. The invention relates to needle-threaders having a butt end provided with a longitudinal wedge-shaped slit to receive the thread. The device is constructed of a thin narrow plate of metal, the thread is laid between the curved convex ends of the jaws and pressed or drawn along the slit, and thus into the eye, the elasticity of the jaws permitting them to yield slightly so that the operation is easily and quickly effected.

PENCIL SHARPENER.—C. DE L. ALLEN and J. C. MAUGANS, 501 W. 133d St., New York, N. Y. Among the principal objects of the invention are, to provide a reservoir for the dust and other waste produced when sharpening a



A PERSPECTIVE VIEW OF THE SHARPENER

pencil, to provide a fixture having renewable sharpening exposed surfaces, to furnish in a single apparatus a plurality of sharpening surfaces with sharpening members relatively graduated as to rapidity of operation, and to simplify the construction.

ROAD SIGNAL.—A. R. SCOTT, 1228 Nora Ave., Spokane, Wash. The invention relates to that class of road signals consisting of light-reflectors arranged at an angle or curve of a roadway. The signal consists of a pair of light receiving plates mounted adjacent a road bend, each plate disposed in a plane perpendicular to a plane coincident with the median line of each arm of the bend, and means carried by each plate to indicate to a driver on one branch of the bend the direction of the other branch.

Hardware and Tools

WIRE CLAMP.—T. R. BRUMFIELD, R. F. D. No. 4, Danville, Va. The invention relates generally to wire clamps, and more particularly to a readily adjustable clamp which will, without undue complication, accommodate a great variety of different gages of wire, clamping such gages in an effective manner in connection with the joining of wire ends or other operations.

Machines and Mechanical Devices

ADDING AND SUBTRACTING MACHINE.—J. F. ANDERSON, 307 London St., Seattle, Wash. The invention relates to calculating machines having a series of number wheels and step transmission means for registering tens, hundreds, etc. The invention more particularly relates to a machine whereby the operation of adding and subtracting may be carried out without any change or adjustment of the number wheels or other parts and solely through the reverse movement of the operating means thereof.

ROD BENDING MACHINE.—C. A. NELSON, Box 261, Cristobal, Canal Zone, Panama. This invention has for an object the provision of a construction whereby a number of rods may be quickly and accurately bent at one operation. Another object is to provide a bending machine with a number of bending elements spaced apart whereby a single rod may be bent successively along its length for producing certain bends or indentations.

SPEED CHANGE GEARING.—A. FRETZ, 217 S. Broadway, Edmond, Okla. The invention relates to power transmission mechanism, it being more particularly an object of the invention to provide a speed gearing including a segment carrier forming a part of the drive shaft, on which a pair of worm segments are mounted for oscillation, and arranged to cooperate with diamond-shaped teeth on the driven disk of the driven shaft.

TURRET MACHINE.—D. W. WOOD, care of Wood Turret Machine Co., Brazil, Ind. The invention relates to lathes, drill presses, and similar machines using a turret and stop rods. The object is to provide a turret machine arranged to eliminate all lost motion in the revolving turret head especially when doing heavy work. Another object is to hold the turret head against accidental turning even should the operator fail to bind the head in place on the slide. A further object is to permit of taking up any wear of the turret head on its pivot pin without changing the alinement.

FLUID MEASURING DEVICE.—S. F. MIOTON, 2523 Esplanade Ave., New Orleans, La. This invention has for its object to provide a fluid measuring device having a measure into which a fluid may flow through a valve, adjustable means being provided for actuating the valve when any one of a plurality of quantities of the fluid has flowed into the measure. Another object is to provide a device having a valve which cannot be closed until the amount of fluid for which it has been set has been measured.

ROTARY PUMP.—G. BEY, 61 Gauter Ave., Jersey City, N. J. This invention relates particularly to a reciprocating rotary pump, and has for an object the provision of an arrangement of wearing plate coacting with the piston of the pump. Another object is to provide means for adjusting the stroke of the pump when the pump is stationary or while it is in motion so as to regulate the flow of the pump.

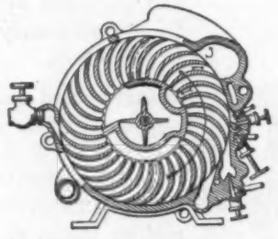
BEAN POLISHER.—C. W. NARAMOR, Mecosta, Mich. The invention relates to machines for polishing beans and more particularly to that type of polisher in which dry sawdust, cracked corn or bran is used mixed with the beans and the mixture agitated while passing through certain cycles of movement. When the polishing cylinder is set for the amount of beans it is desired to run the machine works automatically and will take care of itself.

Musical Devices

BANJO RESONATOR.—L. YOSCO, 204 W. 34th St., New York, N. Y. The object of the invention is to provide a construction which will cause a banjo to have a clear tone in rainy or wet weather as well as in dry weather. A still further object is to provide a banjo or similar instrument with a resonator so formed as to increase the volume and improve the quality of tone as well as make it a dependable instrument in all kinds of weather.

Prime Movers and Their Accessories

GAS TURBINE. J. TAYLOR, Commonwealth Ave., Salt Lake City, Utah. The invention relates to gas turbines of that type in which the rotor is driven by the explosive force of a mixture of fuel and air working in the pockets on the rotor. The objects are to provide a turbine in which the explosive mixture in each pocket is automatically

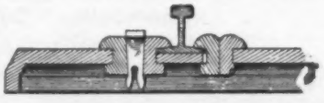


A VERTICAL SECTION OF THE TURBINE

ignited as the pocket reaches an ignition chamber of such arrangement that flame will propagate from one pocket to the succeeding pocket, there being an electric igniter in the chamber for starting purposes also means for supplying priming fuel for starting.

Railways and Their Accessories

METALLIC RAILROAD TIE.—C. RUGGABER, Savannah, Ga. The object of the invention is to provide a tie having means for rigidly connecting the rails to the tie. The device provides a tie having transverse grooves on its upper surface for the seating of the rails, and of a width



A LONGITUDINAL SECTION OF THE TIE AND A RAIL

and depth to receive the base flanges of the rails, said tie having openings at each side of the groove for receiving locks to lock the rails to the tie, locking devices being provided for the inside of each rail, for preventing inward or upward movement.

JOURNAL OR AXLE BEARING.—W. M. HEINA, 553 W. 184th St., New York, N. Y. This invention has particular reference to bearings of the smooth or plain type as distinguished from the so-called anti-friction or roller bearings. Among the objects is to provide a bearing that is as near frictionless as possible having maximum strength for the purpose of resisting or supporting either end thrust or lateral loads, whereby the bearing is adapted for use in such places as railway cars or locomotive journals, or steering knuckles of heavy motor trucks where bearings are subjected to crushing strains.

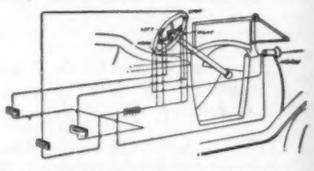
Pertaining to Recreation

TOY PROJECTILE.—J. B. BLACKSHEAR, 113 Hotel St., Honolulu, Territory of Hawaii. This invention relates more particularly to a projectile made up of separable elements adapted to be discharged in assembled form from a toy cannon, it is so constructed and arranged as to maintain its assembled form throughout its trajectory and adapted to be disrupted in a realistic manner by contact when striking an object.

TOY TORPEDO.—J. B. BLACKSHEAR, 113 Hotel St., Honolulu, Territory of Hawaii. An object of the invention is to provide a toy adapted to be embodied in a land torpedo or the like mounted to travel, and comprising spring-controlled means arranged to suddenly cause disruption of the torpedo or body part thereof upon release of the spring by contact of the torpedo with a wall or other fixed object affording the necessary resistance.

Pertaining to Vehicles

STEERING WHEEL CONTROL MEANS FOR ELECTRICALLY OPERATED SIGNALS.—R. S. HANNA, St. Petersburg, Fla. One of the principal objects of the invention is to provide means whereby electrically operated signals



PERSPECTIVE VIEW OF A STEERING WHEEL, THE ELECTRICAL CIRCUITS BEING REPRESENTED

carried on a motor car may be controlled and actuated without the necessity of the driver moving his hands from the steering wheel. Another object resides in the arrangement of finger actuated blocks in such a manner that they will not become accidentally depressed by reason of the driver's hands moving into various positions on the steering wheel.

CRANK HANGER BEARING.—C. H. MILLER, 3509 Windsor Ave., Kansas City, Miss. The invention relates particularly to one-piece crank hangers for bicycles. An object is to provide a bearing characterized by a divisible cone seat, together with a divisible assembly sleeve which is so coordinated with the shaft and crank as well as the cups, that the whole may be readily assembled on the shaft and the latter with its crank slipped in position in the slotted hanger, the arrangement resulting in less wear and reduced friction, and consequently easier running.

LEAF SPRING.—H. RIGBY, 899 E. 19th St., Paterson, N. J. The invention relates to leaf springs such as are used in automobiles and other vehicles. An object is to provide the stock of which the leaves are made with longitudinally extending grooves during the process of rolling the stock. The spring is composed of a plurality of superimposed leaves each having one face flat and smooth, and the other face provided with longitudinally extending grooves over which extends the smooth, flat face of the next adjacent leaf, the grooves supplying means for lubrication.

RESILIENT WHEEL.—O. E. PETERSON, Idaho Falls, Idaho. This invention relates to resilient wheels of the type in which an inner wheel rim is cushioned upon a pneumatic tube interposed between the inner wheel rim and the hub of the wheel. Among the principal objects is to provide means for acquiring a positive drive between the driving axle and the inner wheel rim, and means for mounting the wheel on the hub.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject-matter involved, or of the specialized, technical or scientific knowledge required therefor.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & CO., Patent Attorneys.
233 Broadway, New York, N. Y.
Branch Office: 625 F Street, Washington, D. C.

LEGAL NOTICES

PATENTS

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to **Patents, Trade Marks, Foreign Patents, etc.**

SCIENTIFIC AMERICAN

contains Patent Office Notes. Decisions of interest to inventors—and particulars of recently patented inventions.

MUNN & CO., SOLICITORS OF PATENTS

626 Woolworth Bldg., NEW YORK and 625 F Street, WASHINGTON, D. C.

Annual Subscription Rates
Scientific American Publications

Scientific American (established 1845) one year $5.00
Scientific American Supplement (established 1876) one year 5.00
Postage prepaid in United States and possessions, Mexico, Cuba and Panama

Foreign Postage

Scientific American $1.50 per year additional.
Scientific American Supplement $1.00 per year additional.

Canadian Postage

Scientific American 75c per year additional.
Scientific American Supplement 50c per year additional.
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application

Remit by postal or express money order, bank draft or check

Classified Advertisements

Advertising in this column is $1.00 a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

FOR SALE

PATENT rights on interlocking rail joint or rights to manufacture on royalty basis. Joint obviates danger of rails being tampered with. Easy to apply. For particulars address E. E. August, 1439 So. State St., Chicago.

FOR SALE

6 No. 12 SWEETLAND FILTER PRESSES

complete with filtering leaves; leaves spaced approximately 3" centers. Each press equipped with a 9" Hydraulic Cylinder to facilitate opening and closing lower body.

Apply to

KEASBEY & MATTISON CO.
Ambler, Penna.

Learn Auto and Tractor Business

Immense growth of the industry, following the war, has made greater demand than ever for garages and motor mechanics. **Learn in 6 to 8 weeks.** Same practical method, same enormous equipment we used during war to train thousands of motor-mechanics for U. S. Army in 60 day courses. Free Book explains all. Write today.

RAKE AUTO & TRACTOR SCHOOL, 2912 Oak Street, KANSAS CITY, MO.

Rider Agents Wanted

Everywhere to ride and exhibit the new **Ranger Motorbike** completely equipped with electric light and horn, carrier, stand, tool tank, coaster-brake, mud guards and anti-skid tires. **Choice of 44 other styles,** colors and sizes in the famous **"Ranger"** line of bicycles.

DELIVERED FREE on approval and **30 DAYS TRIAL.** Send for big free catalog and particulars of our *Factory-direct-to-Rider* marvelous offers and terms.

TIRES Lamps, Horns, Wheels, Sundries, and parts for all bicycles—at half usual prices.

SEND NO MONEY but tell us exactly what you need. Do not buy until you get our prices, terms and the big FREE catalog.

MEAD CYCLE COMPANY Dept. M-175 CHICAGO

The Current Supplement

MUCH interest inheres in the tremendous preparations which the United States had instituted for a gas offensive which would throw completely into the shade anything that the Huns had ever attempted, and make them sincerely regret that they had ever started this kind of warfare. Manufacturing operations were, at the time of the armistice, being carried out on a scale truly appalling. The timely story of this work is told in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2255, for March 22d, under the title *Gas Offensive, A Record Achievement.* In the same issue a native of Poland and student of Polish history gives an illuminating account of *The Naval Forces of Old Poland.* An important discussion of certain aspects of the crystalline and colloidal states which have heretofore received little attention will be found under the rather awe-inspiring title *Dispersoidology.* An illustrated account of the manufacture of wall paper covers a field which in spite of its superficial commonplaceness is but little known to the average mortal. The mathematically inclined will follow with pleasure the discussion of *Stream Line Motions and Waves,* which carries three illuminating diagrams. A surgeon in the United States Public Health Service details his observations upon the *Flight of Mosquitoes through Horizontal Water Pipes,* making some significant suggestions regarding the propagation and prevention of mosquito-borne disease. The article on *Fluorescence* is concluded from the previous issue. The important work of the Federal Government looking toward the reforestation of areas naturally desert or burned over is described and illustrated in *Trees for the Desert.* In addition there are numerous shorter articles of interest.

The Miami Conservancy Flood Prevention Plan

(*Continued from page 282*)

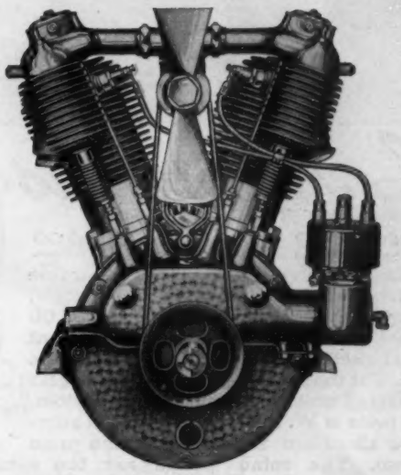
The advisability of putting a system of reservoirs in the flooded territory was carefully considered and rejected. The failure of the Loraine Reservoir in 1913 showed the inefficiency of such a system and no practical net-work could hold in check the vast amount of water necessary for protection. The engineers finally decided upon five immense retarding basins in different points of the Miami Valley and extensive channel improvements. The retarding basin or dry basin was better because the farm lands in the basin will be wet the shortest time; the basins will be quickly ready for new service in the event of a second storm following the first in close succession; during the early part of a storm, the basin will be empty and available to capacity for storing the crest of the flood; and the dams, being dry the greater part of the time, will not be so likely to become damaged as they would if constantly subject to the wash of the water.

The retarding basins are especially good for this kind of work. They are, in brief, large valleys through which runs some branch of the Great Miami system, having an enormous dam across the lower portion. These dams are provided with large conduits to accommodate the steady flow of the stream. The conduits are placed at the extreme level and made like long tunnels of huge blocks of concrete based on living rock.

Each dam is pierced by two to four such conduits, permanently opened, located at the base of the dam. They are to pass the normal riverflow and in flood to discharge water under head. No gates, stoplog notches, or other closure devices are present to encumber the dam. The entire system works altogether automatically. The entrance of each of the conduits is protected from drift by concrete piers and a floating boom.

Enormous volumes of water will be discharged from the conduits at the maximum flood. They are so proportioned in relation to the drainage area and basin as to

SPACKE 9-13 DE-LUXE MOTORS



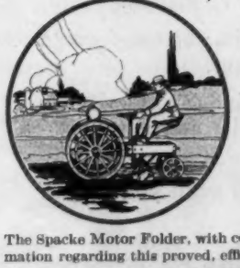
The World's Most Efficient Small Motor

The small, light-weight, efficient gasoline motor sets new standards in design, manufacture and service of interest to everyone.

The Spacke Motor, shown above, is a practical power plant—proved by service—thousands are now in use.

It actually weighs less than 100 pounds complete. Yet it easily develops from 9 to 13 horse power on less than half the gasoline consumption of the average gasoline engine.

Has Hundreds of Uses



Designers and manufacturers of light-weight passenger and delivery cars, farm tractors or cultivators, railway "speeders," motor boats or any motor-operated mechanism where light weight and efficiency are necessary will find wonderful opportunities presented by Spacke Motors.

We are prepared to furnish these standardized motors in any quantity from one to a hundred thousand.

The Spacke Motor Folder, with complete specifications, test records and interesting information regarding this proved, efficient power plant, is yours on request. Write today to

The Spacke Machine & Tool Co.

Makers of Spacke Motors, Spacke Axles and Automotive Parts

Factories and Offices: Indianapolis, U. S. A.

W. L. Douglas

"THE SHOE THAT HOLDS ITS SHAPE"

$4.00 $4.50 $5.00 $6.00 $7.00 & $8.00

IF you have been paying $10.00 to $12.00 for fine shoes, a trial will convince you that for style, comfort and service W.L.Douglas $7.00 and $8.00 shoes are equally as good and will give excellent satisfaction. The actual value is determined and the retail price fixed at the factory before W.L.Douglas name and the retail price is stamped on the bottom. The stamped price is W. L. Douglas personal guarantee that the shoes are always worth the price paid for them. The retail prices are the same everywhere. They cost no more in San Francisco than they do in New York.

Stamping the price on every pair of shoes as a protection against high prices and unreasonable profits is only one example of the constant endeavor of W.L.Douglas to protect his customers. The quality of W. L. Douglas product is guaranteed by more than 40 years experience in making fine shoes. The smart styles are the leaders in the fashion centers of America. They are made in a well-equipped factory at Brockton, Mass., by the highest paid, skilled shoemakers under the direction and supervision of experienced men, all working with an honest determination to make the best shoes for the price that money can buy.

CAUTION—Before you buy be sure W.L.Douglas name and the retail price is stamped on the bottom and the inside top facing. If the stamped price has been mutilated, BEWARE OF FRAUD.

For sale by 106 W.L.Douglas stores and over 9000 W. L. Douglas dealers, or can be ordered direct from factory by mail, Parcel Post charges prepaid. Write for Illustrated Catalog showing how to order by mail.

W.L.Douglas

President W.L.DOUGLAS SHOE COMPANY. 166 SPARK STREET, BROCKTON - - MASS.

Are You Going After Foreign Trade?

If so are you sure that your inventions and trade-marks actually belong to you in foreign markets?

Unless you avail yourself of the right to acquire foreign patents and trade-mark registrations, you may find that another has preceded you and has actually appropriated your inventions and trade-marks and obtained legal ownership thereof, whereby he can bar your goods from foreign markets. Such a proceeding is permissible under the laws of many foreign countries.

Many have lost their markets in certain foreign countries by overlooking this fact.

Many of our clients are preparing to extend their business by seeking patent and trade-mark protection in foreign countries.

We should be glad to have you avail yourself of our services.

Foreign Patent and Trade-mark Department

MUNN & CO.

Woolworth Building **New York City**

let the basin fill approximately to spillway level in the assumed maximum flood. The spillways, which probably will never be used, are provided in case of emergency. They have from 15 to 19 feet freeboard below the dam crest as a safety margin, which amounts to about 40 per cent over the maximum flood. In floods twice as large as that of 1913, the dams will have a freeboard of about 15 feet, determined upon the height of the dam.

Of the five retarding basins, three lie immediately above Dayton in the main streams that join within that city. The Taylorsville basin is on the Miami, the Englewood on Stillwater, and the Huffman on Mad River. These limit the extreme concentration that takes place at the base of the main part of the Valley. This section has a very high concentration rate due to the fan-shaped arrangement of the rivers coming together here and the straight supply channels.

Of the other two retarding basins, Lockington controls the Upper Miami, protecting Piqua and Troy, while the Germantown basin on Twin Creek protects Middletown. To develop fully the Taylorsville basin would submerge much of Tippecanoe City, a village five miles above the site of the dam, and Troy lying several miles farther north would probably also be affected. Similar conditions apply to the Huffman basin where the cost of more radical adjustment would be prohibitive. In consequence these basins are of smaller capacity than the others in relation to their position and drainage area. The table which we print herewith will give a very good idea of the size and dimensions of the various dams constructed.

It will require three years to build the Englewood basin, the largest of the projects, and three weeks for it to empty after maximum storage. It supplements the Huffman and Taylorsville Basins vitally, because it reduces Stillwater River at Dayton from 88,000 to 12,000 second-feet.

The construction of the retarding basins is foolproof and automatic. They do not require constant care and are so constructed that they will be in as good condition a century from now, even if totally neglected, as they will be the day they are finished. The conduits can discharge large volumes of water at high spouting velocities without damage. The Taylorsville dam, which has the largest conduits, can discharge 55,000 cubic feet per second, nearly as much as the present safe flood-flow capacity of the Miami Channel. The velocity of the discharge had to be brought down from some 50 feet per second to six or eight feet by use of the hydraulic jump or standing wave, stabilized by steps and tailwater weirs.

The construction of the retarding basins necessitates the purchase of much splendid farmland and the changing of many miles of railroad track. For the Huffman basin the main line of the Erie Railroad will be changed for 80,000 feet and the Ohio Electric Railway for 67,000 feet. For the Taylorsville basin, the B. & O. Railroad will be changed along 55,000 feet, and the Big Four along 15 miles. The work commenced over five years ago and will probably be finished about five years from this time. The total cost of the project will run about $25,000,000 and will be raised by special taxation graduated proportionately to the benefit. The whole Miami River Valley will be influenced. The rich land within the basins will be leased and cultivated as heretofore, the houses alone being moved to higher ground. The fact that most of the land will probably never be flooded makes cultivation a good risk. The following table, showing the cost of the main items of the work, will give an idea of the disbursement of the resources:

Retarding Basins, not including Real Estate	$6,735,000
Real Estate in Basins	3,500,000
Channel Work and Local Protection	3,468,000
Real Estate, other than in Basins	2,200,000
Public Utilities, Relocations and Damages	2,307,000
Total, not including interest, taxes, administration and contingencies	$18,210,000

One epoch making departure from precedent in this work is a fact that no steam shovels are used. Huge dragline excavators, the largest made, are employed throughout. Most of them are electrically operated. They carry 125-foot booms with bucket capacity of 3½ cubic yards, and revolve completely without changing their position. Others have from 85- to 100-foot booms carrying five-cubic-yard buckets, taking in one scoop five wagon-loads of dirt. It will be remembered that the Panama Canal engineers used only steam shovels and thus had very limited radius. The radius of action of Miami Conservancy dragline excavators covers over 100 feet.

Much legal procedure was necessary before the work could be got under way. Chief Engineer Morgan drafted the Conservancy Act, as there was no existing law under which the work could be done and especial assessment levied to pay for it; and his text was passed without revision. The Supreme Court tested the validity of the law in many ways and it was not until June, 1915, that the Miami Conservancy District was verified beyond dispute as a legal department under the State. An immense bond issue was floated to carry the work until the assessments could be collected, and $10,000,000 worth were sold in Dayton alone. The district employs about 1,600 men. Many noted engineering authorities are connected with the work besides the Chief Engineer. Chas. H. Hall, the assistant engineer, built the Arrow Rock Dam in Idaho, which at that time was the highest masonry dam in the world. Charles H. Locker, who has done a great deal of the contracting work in the United States, is the construction engineer. Gerald H. Matthes, the office engineer, was in charge of the collection of rainfall data during the early days of the project and accomplished a work that appeared too monumental to be attempted. The river channel improvements are very extensive and include deepening and straightening the channels of the various streams in the Great Miami Valley, and strengthening the levees. It is a work not only for the present but for future generations and will last for probably three centuries with very little or no improvement.

Reconstruction in Europe

(*Continued from page 284*)

and the terror of the lockout; these are no less pressing now than ever. The difference is that now labor has a share in the working out of the policies which will avoid such difficulties, and can aid in shaping the destinies of industry as well as of trades unions, to the mutual advantage of nation and worker, where previously labor could but resist after trouble had come, or suffer after injustice had been done.

As has been sketched in previous articles in this series, the government is endeavoring by every means in its power to shorten that dreaded period of transition from a war to a peace basis, and to keep a sane balance in men's minds by many means, chief of which is an unemployment benefit of 24 shillings a week for 13 weeks during the six months beginning November 25th, with additional sums for dependent children. Demobilization is not to be carried out at a speed which will paralyse industry's ability to reabsorb. Reconstruction measures are under way that will start up many public works, that will solve to some extent at least the very pressing housing problem, that will produce new sources of wood supply by reforestation, that will both reclaim land now wasted and

(*Continued on page 302*)

You Can't Figure the Cost of Power by Figuring "Power Cost"

Even the most carefully compiled "Power Cost" figures may not tell all about the *cost of power* in your factory.

You may know just what fraction of a horsepower-hour it takes to turn this piece or grind that one, and exactly what that power costs in dollars, cents and even to the fraction of a cent.

You may know exactly the cost of power you lose through idle machines—through friction and through long lines of shafting and belts.

But it's harder by far to figure how much inadequate or worngly applied power is costing you, or how much you lose from inability to run each machine at exactly the proper cutting speed, which can be so easily maintained in the motor driven shop.

Moreover it is extremely difficult to determine how much spoilage comes from the imperfect control that is unavoidable where electric motors have not yet come to replace long lines of overhead shafting.

"Cost of Power" can always be decreased by the right motor installation. To be sure that you get the proper type and size of motor for your requirements, call on Westinghouse engineers. They are always ready to give their advice and make recommendations based on your particular set of conditions.

W
WESTINGHOUSE ELECTRIC

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh, Pa.

Westinghouse
ELECTRIC MOTORS AND CONTROLLERS

Handling Heavy Loads

The facility with which great masses of metal are handled in modern foundries and machine shops is truly remarkable. Immense naval guns, heavy dynamos, engines and boilers are picked up and carried from place to place with wonderful ease and certainty.

Wire ropes, strong but supple, connect the powerful overhead crane with its heavy burden. Through them, the lifting power above is made available below.

Wherever there is a load to pull, to hoist, to sustain, there you find wire ropes, often overloaded, generally neglected, still "carrying on."

There is a grade of Broderick & Bascom Wire Rope for every purpose. These grades have been carefully standardized and the standards are rigidly maintained. Because wire of suitably high grade for our Yellow Strand Wire Rope could not be obtained during the war, the manufacture of Yellow Strand was temporarily suspended but will soon be resumed.

There is safety in specifying B. & B. Wire Ropes.

BRODERICK & BASCOM ROPE CO., ST. LOUIS NEW YORK CITY SEATTLE, WASH.

Factories St. Louis and Seattle.

B-30

Broderick & Bascom Wire Rope

The Value of Suggestion

In a recent interference proceeding involving five separate applicants for a patent, three of them attributed their conception of the invention to an illustrated article appearing in the SCIENTIFIC AMERICAN. By placing before your engineers, designers and mechanics for systematic study, copies of patents, you may stir their inventive faculties to your great advantage.

We can furnish complete sets of ***United States Patents****--properly classified--relating to your particular line of work in convenient form for ready reference. Write our Manufacturers Service Department.*

SCIENTIFIC AMERICAN

626 Woolworth Building *New York City*

Reconstruction in Europe

(Continued from page 300)

make available for cultivation land now held in parks and estates, that will in a hundred other ways directly affect the comfort and the life of the individual. Adult education is getting much attention, as are extension courses for soliders in process of demobilization; and a general attempt is being earnestly made by the entire government to bring capital and labor, industry and craftsman, to a state of mutual confidence and mutual forbearance during the difficult years just ahead.

How the problem will finally find solution no man may guess. But labor as a class has so whole-heartedly and so magnificently "got on with the war" that to the onlooker from another land, it does seem as if the government had been wise in time, and as if it were not possible for labor as a class, either to raise the snake-like head of Bolshevism or seriously to embarrass what they naturally consider to be the greatest nation in the world, in her progress towards a newer and a better national life.

How Will the Gasoline Engine Develop?

(Continued from page 285)

soon reach a temperature at which they would lose their strength and disrupt.

As for the 35 per cent of heat that passes out through the exhaust pipe in the form of gas at high pressure, attempts have been made to utilize it by expanding the gas a second time in a larger cylinder—as is done in steam-engine practice; likewise by giving the piston a variable stroke, the intake being short and the expansion stroke proportionately long to carry expansion to a comparatively low pressure. These and other expedients have been more or less exhaustively tried out, but they have added so much weight and complication and noise and expense that none has ever got much past the experimental stage.

Such, roughly, is the present state of affairs. Suppose we consider for a moment the work that is being done today looking toward greater efficiency. So far as thermal efficiency is concerned the best results are obtained with a single cylinder. Sweeping all detailed discussion aside, however, the single-cylinder engine is impracticable, as we now know it, for anything except stationary and heavy marine work.

It is apparent, however, that the expedient of multiplying cylinders is simply the easiest way we have for making the best of an evil without going to the root of the matter and eliminating the evil itself. This is well recognized in the present tendency toward designs in which each individual cylinder is brought to a higher efficiency. One automobile manufacturer has suceeded in increasing the maximum power of a six-cylinder engine approximately forty per cent by using two intake and two exhaust valves instead of the usual one, and has increased the overall efficiency about thirty per cent, all by just making it easier for the gases to get in and out. Similar and equally good results have been obtained by makers of four-cylinder engines. Higher power, greater flexibility, smaller fuel consumption, all have been obtained without increasing cylinder dimensions. Much has been and is being done by controlling heat, which means nothing more or less than supplying means for keeping the engine running at the highest practicable temperature. This eliminates the waste that is entailed in allowing the cooling water to carry off more heat than is necessary for keeping the lubricating oil in working condition.

When the gasoline engine was very young the lubrication problem was one of the big ones, and overcooling was necessary in order to maintain a film of oil between walls and piston. By degrees oils were improved and much efficiency gained. The continued improvement of oil, or the development of another method of lubrication, is something that holds out further hope. As a matter of fact there is available a lubricant that remains unaffected by any such temperatures as are attained in internal combustion engines. I refer to graphite, which is constantly finding new uses and extensions of old uses. It has a strong affinity for cast iron, and the development of means for using it in cylinder lubrication does not seem impossible. This would permit a working temperature probably higher than present cast irons would stand. Should this come to pass it would be up to the metallurgists to produce a metal that would support the temperature.

Another point here: the running of an engine at temperatures considerably higher than at present possible would probably eliminate water-cooling; it would be a matter of small difficulty to carry off, by air alone, the heat that could not be converted into power. Perhaps it could even be done without the weight-adding fins and flanges that are now necessary on air-cooled cylinders.

One result of such a development would be greatly to reduce the weight and size for a given power output. In the case of the automobile engine, this would have important effects upon the design of the car as a whole. At present the chassis must be strong in proportion to the weight of the engine. The lightening of the engine would permit the lightening of the whole car. A case in point is that of a manufacturer who, a few years ago, worked out an engine with an aluminum cylinder block, in which light cast-iron liners took the wear of the pistons. Without reducing the power or the capacity of the car the weight was cut down more than half a ton.

While on the subject of weight it may be pointed out that there are great possibilities in rather plain view. The much neglected two-stroke cycle points the way. It is highly probable that had this principle been adopted as has the four-cycle, had it been the subject of the same general concentration, it would have developed into something much better than anything we now have. The four-cycle engine has been so close to our eyes that it has been difficult to see anything else; but its further development along its present lines appears to offer opportunities that are small in comparison with those of the two-cycle. It is therefore not unreasonable to assume that at no distant date the latter will be taken up by the engineering world more seriously than heretofore.

Already we know that it is entirely possible nearly, and in a few cases actually, to double the power of a cylinder of given dimensions by substituting the two-stroke cycle for the four. This would not mean cutting the weight in two, for the shaft, connecting-rods and case must be sufficiently substantial to take the additional stresses. But carry the matter to its logical conclusion and let one cylinder do what a steam-engine cylinder does—provide an impulse at every piston stroke, two impulses for every revolution of the shaft. Or we may leap boldly over a whole catalog of ifs and buts to foresee, as one of the engines of the future, one with a single cylinder working on the two-cycle principle and double-acting, having an explosion at every piston stroke.

This would involve something more than the present length; but there would be more than a corresponding reduction in other dimensions. Assume the existence of a method of lubrication, of metals which would permit at the same time operation at comparatively high temperatures and construction lighter than is now feasible—and we should have an engine which instead of weighing 500 pounds for a 40-horse-power output would weigh but 150 pounds. Such an engine could be placed almost anywhere in a chassis; it is safe to say that it would bring into existence an entirely new type of car, in which engine position would be a secondary

DURAND Steel Racks

DURAND Steel Racks, with adjustable shelves, bin fronts, dividers, etc., are capable of an infinite number of combinations for every purpose.

Any size or shape of compartment can be formed in a minute by change of spacing; all parts are accurate and smooth-fitting.

An entire bin can be removed easily when not needed, and stored away compactly or re-set up elsewhere.

Write us of your particular needs regarding steel racks, or steel lockers. Catalogue of either on application.

DURAND STEEL LOCKER CO.

1574 Ft. Dearborn Bk. Bldg. Chicago — 974 Vanderbilt Bldg. New York

consideration instead of the first question to be settled. The many attempts that have been made to mount the engine on the rear axle are at once brought to mind. Such an engine would lend itself readily to this placing; and the elimination of the gear needed to transmit power all the way from the front of the car to the rear would help materially in reducing weight and wearing parts.

Of course all this is speculative. It is by no means wild speculation so long as we keep firmly in mind the fact that the future is certain to bring knowledge that does not now exist. It is unthinkable that such should not be the case, that we are anywhere near the end of our scientific rope. It is no more unreasonable to think on such lines than it would have been, 20 years ago, to build on the possibilities following the general use of a metal almost as strong as cast iron and of but a third its weight; of steels that would hold their cutting edges when red-hot; of power plants weighing little more than two pounds per horse-power; of the successful heavier-than-air flying machine.

It is possible to speculate along kindred lines with equally interesting results. The broad-gage engineer of today is a man of imagination, and he does speculate thus. Take the imagination out of engineering and our engineers would be little more than mechanics.

The Vampire Bat

(Continued from page 287)

particularly the vampire bat, is as safe in its form of structure as the turtle is in his. Both have endured through some pretty tough ages of the world.

Dr. Gerrit S. Miller, Curator of Mammals of the Smithsonian Institution, who wrote the government work on bats, thinks that this bat took a very long time in which to become the sole vampire extant. He writes me:

"The only objection I have to your proposed period of two million years is that it seems to me the period is quite inadequate to allow for the development of the differences between the vampire bats and the fruit-eating bats. I personally have no doubt that both families had essentially their present characteristics at the bottom of the Eocene Age." That would add another million years and mean that when first mammals arose in the Tertiary, blood-sucking bats arose with them to discourage their proposed reign on earth. I always assume in estimates of geologic time, that first comers of each new age were allowed a little time to get used to conditions and establish themselves before pests came along to exterminate them. Otherwise, we would have no animal life left in the world. As it is, reproduction of every species is required on a vast scale, so that a few of each type may escape and endure.

Equally important, from the standpoint of naturalists, is the large collection of fruit-eating and insect-eating bats from the Congo, which are now being prepared for exhibition at the American Museum. They have little, if any relationships with the vampires of South America, except in outward appearance when in flight and in the habits of all bats of hanging up by their hind claws when at rest. The bat gave up his forearms and fingers to form his parachute of wings. In consequence, and in order that he might have as wide and deep wings as possible, his hind claws were attached to the bottom of the wings for grasping and not for walking. Humans cannot stand on their heads long, because of the rush of blood the wrong way. The bat, however, has a compressed chest by which it controls the flow of blood. So when he hangs himself head downward, his blood circulates as normally as when in flight. He can only move along the ground by aid of his wings, balancing his feet, and then moves as if a victim of alcoholism. Fruit-eating bats have what is termed a leaf nose, which means that after piercing fruits with their teeth, they can distend the

The Fatherless Children of France, Inc.

need YOUR help TO-DAY

even Peace cannot bring back the dead soldier to his child.

THEREFORE

We Want You to Give

10c a Day
or $3.00 a Month
or $36.50 a Year

To "adopt" a Little Orphan of France. Its Name and Address will be sent you on request.

NEW YORK COMMITTEE

Chairman:
Miss Luisita Leland
11 West 46th Street

Vice-Chairman: Mrs. J. Borden Harriman
Secretary: Mrs. Douglas Robinson
Treasurer: Alexander J. Hemphill, 140 Broadway

I Pledge Myself to Give:

$..... for .....fatherless { children / child } of France for { one year / two years }

$..... as a donation toward the support of a child.

Do you desire name and address of child.....?

Date.....

Name.....

Address.....

Subscriptions payable by year, month or quarter.

Make checks to and send to New York Committee Treasurer.

SIMONDS SAW STEEL PRODUCTS

You Can Have Some Of This Steel!

For Simonds Saws, the best is none too good—edge holding and wear resisting.

Buying Saws of this steel is *your* protection. Making our own steel is *our* protection for the broad guaranty we give on all

Simonds Saw Steel Products

Manufacturers requiring flat steel plates can secure them from us, hardened, tempered and ground to specifications—and of the same quality that has made our chief product, Simonds Saws for cutting wood or metal, famous the world over.

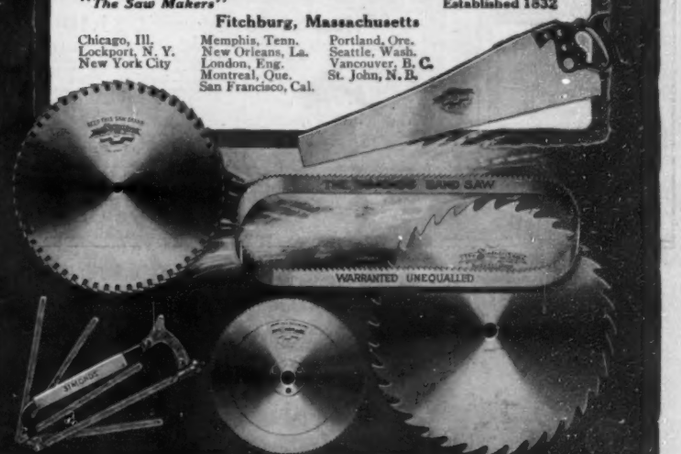
Your Inquiries are invited

Simonds Manufacturing Company

"The Saw Makers" Established 1832

Fitchburg, Massachusetts

Chicago, Ill. Lockport, N. Y. New York City — Memphis, Tenn. New Orleans, La. London, Eng. Montreal, Que. San Francisco, Cal. — Portland, Ore. Seattle, Wash. Vancouver, B. C. St. John, N. B.



DON'T PAY GARAGE RENT ANY LONGER

"Pre-rent" $95.00 Portable Garage (One-Car Size)

All complete—doors, windows and even paint. All wood. Just bolt together the 10 sections and drive in your car. Easily portable. 9 sizes. The one size pictured on left only $126. Write for booklet.

MANUFACTURERS' OUTLET COMPANY
403 Walden Avenue Buffalo, N. Y.

ECONOMY renewable FUSES

insure maximum safety and minimum cost in safeguarding electrical circuits against the fire and accident hazards of overloads and short circuits. An inexpensive "Drop Out" Renewal Link restores a blown Economy Fuse to its original efficiency. The Economy is the pioneer renewable fuse. As compared with the use of one-time fuses, it cuts annual fuse maintenance costs approximately 80 per cent.

ECONOMY FUSE & MFG. CO.
Kinzie and Orleans Sts., CHICAGO, U. S. A.
Exclusive manufacturers of "ARELESS"—the Non-Renewable Fuse with the 100 p. c. Guar. Indicator.
Economy Fuses are also made in Canada at Montreal

DU PONT AMERICAN INDUSTRIES

As Clear as Crystal

The dominant features of Transparent Py-ra-lin Sheeting are flexibility, toughness, clear vision and long service.

TRANSPARENT PY-RA-LIN SHEETING
(A duPont Product)

is the first thought of all experienced auto top and jiffy curtain makers. Used now for window materials, goggles, visible card holders and scores of other things.

We also manufacture Py-ra-lin in Ivory, Tortoise Shell and various plain and mottled colors, in sheets, rods and tubes for use in the interior decoration and equipment of high-class closed body jobs.

Write for samples and literature

The Arlington Works
owned and operated by
E. I. duPont de Nemours & Co.

DU PONT

The Model T Ford Car

Its Construction, Operation and Repair
By VICTOR W. PAGE, M. E.
A New, Complete Book for every Ford Owner, Dealer, Salesman and Repairman.
300 (5x7) Pages. Over 100 Specially Made Engravings and 2 Large Folding Plates

Price, $1.00; by mail, $1.10

This is the MOST COMPLETE and PRACTICAL instruction book ever published on the FORD CAR. All parts of the Ford Model T car are described and illustrated in a comprehensive manner—nothing is left for the reader to guess at. The construction is fully treated and OPERATING PRINCIPLES MADE CLEAR TO EVERYONE. Complete instructions for driving and repairing are given. Every detail is treated in a non-technical yet thorough manner.

This book is written specially for FORD DRIVERS and OWNERS, by a recognized automobile engineering authority and an expert on the FORD, who has driven and repaired Ford Cars for a number of years. He writes for the average Man in a practical way from actual knowledge. ALL REPAIR PROCESSES ARE ILLUSTRATED AND FULLY EXPLAINED.

SCIENTIFIC AMERICAN PUBLISHING CO.
233 Broadway Woolworth Building New York, N. Y.

It Doesn't Pay to Guess
—Just because work *seems* to be accurate is no sign it is. The way to be sure is to use the dependable

Starrett Tools

known the world over as standard for accuracy. Write for Catalog No. 21B
The L. S. Starrett Co., Athol, Mass.
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

mouth lips and tongue so as to suck and dig out the contents of an apple or other fruit. The new Bulletin of the American Museum Congo Expedition Collection of Bats, by J. A. Allen, Herbert Lang and James P. Chapin, states, among much else:

"The collection consists of 794 specimens, representing 68 forms of bats not heretofore known to this museum, and other museums of this country have comparatively little. Of these 29 are new species and two are new sub-species, not known in any museum of the old world. They were collected in 27 localities, in each of which exploration radiated 40 miles from camps occupied. The area covered was the west African rain forest, 3,000 miles long and 450 miles wide. Fruit bats are naturally common therein, where fruit ripens throughout the year. Since fruits are not equally plentiful in all locations, fruit-eating bats have to shift continually, being unable anywhere to have established roosts. Their only possible solution of the food question, is large flights in great numbers, with neither date nor locality—just hunting until they find fruit in season. Seasons present opposites north and south of the equator, but journeys must be made by the bats to adapt themselves to fruit-bearing periods, even if desert wastes must be crossed. Since fruit is their only food, it is hardly possible that their eyes alone, though relatively large, should suffice to discover it. Their great flights, resembling migrations, makes us feel sure that their sense of smell is very highly developed, and our experiments show that it is probably their principal guide, since the fragrance of ripe fruits is often very strong. In nearly all fruit bats the nasal region is extremely long, with well developed ethmoids as a special provision for the highly sensitive organs of smell. The large olfactory lobes also show that smell with them is a very important factor. The skull with very few exceptions is elongate and rather smooth in outline. The brain cavity is rather small, a certain sluggishness in temper and action distinguishing them from the more active insectiverous and fruit-eating bats.

The mandible with its long, interrupted tooth row is slender and weak, and is operated by rather poorly developed jaw muscles. The canine teeth are fairly long, rather dull, and often round in the transverse section, fit for wrenching off, cutting open fruits, or holding them in the mouth during flight. The cheek teeth, with crowns often narrow, are rather degenerate and are chiefly of assurance in separating the pulp from the fiber, as in mangoes, or in squeezing out juices from the pulp. Their food requires little or no mastication.

"The very extensible tongue is beset on top with gustatory and tactual papillae. The latter are often arranged in a patch near the tip, tridentate and stiff enough to serve as a rasp, helpful in gathering pulp and juices from inside the fruits after their outer cover has been torn. In some species juices of fruits are also sucked by means of extensive pouches underneath the lips. The digestion is extremely rapid and the quantities of fruit or their juices consumed are large. Hence the great patches of apparently fresh pulp, together with the remants of spoiled fruit, underneath boughs that seem to be used as habitual dining halls.

The destruction they cause may seem to be considerable, but the transportation of these fruits before feeding, sometimes a hundred yards, naturally distributes seed. The seeds sprout readily and grow into trees under favorable influence of moist climate. Valuable fruit trees in this way are planted beyond the cultivated area of the posts. Since the larger species habitually move fruits as large as figs or guavas in fairly great quantities, an important role is played by the fruit bats in the propagation of certain fruit-bearing trees throughout the West African rain forest."

The umbrella bat, *ephomophorus anurus*, which ornaments our cover this week, is an excellent representative of the tribe of African fruit-eating bats. We illustrate it, as well as the vampire, through the courtesy of the American Museum of Natural History.

U. S. Navy 7-inch Caterpillar Mount

(Continued from page 287)

mobile, it had to be ready to move immediately after firing the last shot. This requisite was obtained. The carriage or tractor mount as it is designated consists essentially of two cast steel trunnion bearing plates to which is riveted a structural steel carriage trail. The carriage and trail thus form a rigid unit and are supported on a forged alloy steel axle secured by cap squares in 8.25″ bearings located on the lower extremities of the trunnion bearing plates. The axle revolves in hubs mounted on the structural steel truck frames of the track layer. The total dead load on the axle before firing amounts to about 50,000 pounds.

A gun elevation of 40 degrees was provided and at this elevation a shell weighing 153 pounds fired with a muzzle velocity of 2,800 feet per second attains a range of no less than 25,000 yards. At the instant of firing a total load of 79,000 pounds is thrown on the axle, hence it was necessary to provide tracklayers sufficiently rugged to absorb this heavy blow without deformation. Results of pressure tests on various soils indicated a safe upper limit of 15 pounds ground pressure per square inch; accordingly with this pressure as a maximum, tracklayers 14 feet 7 inches long, 54.5 inches high and 25 inches wide were developed. The resultant pressure per square inch on the ground at the instant of firing is about 13 pounds. The axle load is transmitted through the truck frame to seven cast chrome-steel rollers, thence to the track which consists of cast manganese steel links supported on forged manganese steel shoes. Each tracklayer complete weighs 13,000 pounds. It is interesting to note that had wheels 25 inches in width been used insteader of tracklayers, they would have had to be at least 20 feet in diameter.

The seven-inch gun weighing 28,700 pounds is mounted in a cast-steel slide secured by cap squares in trunnion bearings on the upper extremities of the trunnion bearing plates. Momentum of recoil and counter-recoil is checked and absorbed by means of a hydraulic brake such as is fitted to all naval gun mounts. The pneumatic counter recoil system, *i. e.*, the mechanism installed for the purpose of returning the gun battery after firing is an innovation to naval ordnance. Essentially it consists of an air cylinder mounted on top of the slide within which operates a piston connected to the gun yoke by means of a piston rod. On either side of the main cylinder is another cylinder which serves as a reservoir. The system is initially charged with air at 300 pounds per square inch.

Whenever the gun is fired at a maximum elevation of 40 degrees the air is further compressed to 450 pounds which is sufficient to return the gun to battery.

Sighting arrangements provide for both direct and indirect fire. For laying the gun in elevation suitable elevating gear is provided and limited train in azimuth is effected by means of traversing gear incorporated in the carriage trail. When greater azimuth is required, the rear end of the trail is mounted on a platform of timbers so arranged as to provide for quick and easy train through an arc of 60 degrees.

A 120 horse-power gas engine driven tractor is used when transporting the mount from place to place. A light limber is coupled to the trail during transit. No preparation for transportation is made, other than to couple up the limber and tractor. The total dead weight of mount and limber ready for transportation is 80,000 pounds.

As Automatic As the Thermometer

Opening as the motor warms, closing as the motor cools—the shutters of Harrison Radiators automatically keep the temperature of the motor constant, regardless of season or climate.

Through the use of a thermostat, Harrison Radiator shutters are kept adjusted in such a way as to maintain the temperature of the motor at approximately 170°—the point at which gasoline motors operate at maximum efficiency.

The result means much to the motorist—

A motor always warm for starting.
Improved carburetion and ignition.
Economy of gasoline and oil.
Less wear on working parts.

Harrison Radiator Corporation
Lockport, New York

Summer—Shutters wide open
Spring and Fall—Partly closed
Winter—closed

HARRISON

Automatically Controlled Shutter-Equipped

Radiator

Frederick Palmer
in Collier's

¶Palmer was in the unique position of a veteran war correspondent serving as an official observer with the rank of lieutenant-colonel.

¶He knew what to see, and he saw it! No one man at the front saw more of America's army and its wonderful work.

¶His story—a series of complete and accurate articles—begins in Collier's for March 22nd. Read them for an interesting, reliable account of America in action.

¶*Colonel Palmer's series typifies the articles which you find regularly in Collier's—authoritative, concise, vitally interesting. Besides Colonel Palmer himself, the writer of these articles (associated with Collier's for many years), are Mark Sullivan, Arthur Ruhl, Samuel Hopkins Adams, Richard Washburn Child, Edward Hungerford, and many of similar standing.*

Collier's
THE NATIONAL WEEKLY

More than a million every week

New York's Aeronautical Exposition

(*Continued from page 290*)

is a two-seater, these machines are single-seaters. It is hoped that at an early date these various machines will compete in a race which will soon establish the undisputed supremacy of one of the three types, since it is obvious that all three cannot lay claim to the same title when all the figures do not agree. And again, it is not so long ago that 150 miles per hour was considered the goal of the fast plane. It seems rather sudden for planes to have gone up to over 160 miles an hour. The more skeptical among laymen demand actual and official racing figures rather than mere estimates and trial figures.

Turning from the military planes to sport or civilian planes, the visitor found much of interest. First of all there was the bizarre little Gallaudet twin-pusher monoplane, known as the "Chummy Flyabout." This plane has a span of 33 feet, and is equipped with two-motor-cycle engines of 20 horse-power each. The engines are used together in driving the pair of pusher propellers; but should one engine fail the other would continue to drive both propellers through a system of shafts and bevel gearing. Two seats are provided in this sport plane, arranged side by side just behind the two engines in the nose of the monocoque fuselage. Eight gallons of fuel is carried, which is sufficient for a two-hour flight. The machine weighs 750 pounds, but the designer states that it will soon be reduced to 600 pounds as a result of certain improvements and modifications. With full load, a speed of 40 to 80 miles an hour is claimed for the Gallaudet "Chummy Flyabout." The cost is $3,500 at present.

Another sport plane is the Dayton-Wright "T-4 Messenger," a war machine made over for civilian use. As a military machine it was intended for carrying messages from the front lines to headquarters, and for general liaison work. The "Messenger" is a conventional biplane with a wing span of 19 feet 3 inches, a weight of 636 pounds loaded, and carries an air-cooled De Palma engine of 37 horse-power. Twelve gallons of fuel is carried, which is sufficient for a three-hour flight. The machine has a speed of 85 miles an hour, a landing speed of 37 miles an hour, and can climb to 3,000 feet in ten minutes, according to the manufacturers. This machine sells for $2,500.

While not intended at the present moment as a sport or civilian machine, the Loening M-2 baby seaplane, which has been used by the Navy for submarine patrol work, is perhaps the smallest seaplane ever built for practical work. It occupies so little space that it can readily be packed aboard a submarine. It is a tractor monoplane with two floats. The plane has a span of 19 feet and a chord of four. The engine is a three-cylinder Lawrence 60 horse-power, air cooled. Twelve gallons of fuel is carried, which is sufficient for a two-hour flight. Fully loaded, the machine weighs but 500 pounds. The maximum speed is said to be 100 miles an hour, and the lowest 50 miles an hour.

To one unfamiliar with the broad and highly technical subject of aerodynamics, the matter of horse-power and speed seems most puzzling and inconsistent. On the one hand we find a single-seater military plane making 130 miles an hour with a 300 horse-power engine, and on the other a smaller plane making 80 with but 40 horse-power. Why such a high proportionate speed for such a great difference in horse-power? The answer is that horse-power and speed do not keep in perfect step. That is to say, as the speed demand increases, the horse-power does not rise in arithmetic progression, such as 1, 2, 3, and so on, but in geometric progression, such as 2, 4, 16, 32, and so on. Every 10 miles above 100 miles an hour calls for a vast increase in horse-power, until 300 and 400 and more horse-power is required when 150 miles an hour is reached. That is why a well-designed single-seater can make 70 or 80 miles an hour on 40 horse-power, whereas it requires eight and even ten times that power to double the speed.

Aerial limousine, or enclosed multi-seater planes, were shown at the Exposition, with elaborate fixtures and numerous comforts for those who desire to fly rather than ride from place to place. In fact, this matter of aerial limousines indicates how military planes of the two-seater type can be readily converted into social machines, with little trouble and expense.

That naval aircraft have kept up with military aircraft, despite the rapid advances of the latter, is quite evident. The Exposition disclosed high speed single-seater naval scouts with speeds close to those of the regular run of military airplanes. Then there are the huge anti-submarine patrol craft, such as the Liberty-engined biplanes of our Navy, constructed at the Naval Aircraft Factory in Philadelphia. In fact, when the matter of civilian flying is considered from a really personal point of view, nine chances out of ten the seaplane and the flying boat types are the most attractive. The starting and alighting problem is far simpler with aquatic aircraft than with those which land on solid earth.

Four and a half years of war have given us several reliable power plants for our airplanes. The necessity of detecting and reporting enemy movements, defences, gun emplacements and so on has given us a large collection of cameras and wonderful photographic apparatus. The demands of military aviators have given us excellent aeronautical instruments for measuring altitude, speed, drift, inclination and so on. All these things were on display at the recent Exposition.

If the present design of the airplane is to be accepted as final, then the airplane is practically perfected. There seems little more that can be done in the way of spectacular advances; for the present machines carry great weights, can make high speeds, climb thousands of feet in a few minutes, and are quite reliable, especially in the case of the multiple-engined planes.

Still, when it comes to long distances and sustained flight for many hours, the dirigible will no doubt be the craft adopted for commercial purposes. A dirigible using helium gas is practically a perfected craft; it can be made 800 or 1,000 feet long, with a diameter of 80 or 100 feet; it can carry 20 to 30 tons of useful load; and it can readily be made for a cruising radius of 7,500 miles! For inter-continental transportation, for trans-oceanic flights, and for long-distance travel generally the dirigible is the craft of the future. It can handle passengers at a far lesser cost for distances over 500 miles. When it comes to short journeys, however, say between London and Paris, New York and Washington, and Paris and Brussels, the large airplane, capable of carrying twelve to fourteen passengers, is undoubtedly superior because of its high speed over routes where trains and fast steamers have to be competed with. So for "hops" or short flights, the airplane is destined to be the winged carrier of passengers, mails and light merchandise; while for long journeys the airship will no doubt be the unchallenged transport. It is a far cry from the captive balloons and small Naval dirigible exhibited at the Aeronautical Exposition; but to those who have been following the march of aviation events there is no doubt that they represent the coming commercial airships.

The Wireless Compass

(*Continued from page 291*)

are then led through the holes and laid out on the map. When a compass station sends a bearing to the control station, the operator there draws out a thread to mark the line of direction between the ship and the compass station. As the other bearings are reported, similar marks are laid down; and the point where all the threads intersect is the exact position of the vessel

The largest selling quality pencil in the world

VENUS

VENUS PENCILS

VENUS Pencils insure accuracy, ease, quickness, economy, all-around pencil efficiency. Their superb unvarying quality has made their name synonymous with Pencil Perfection in every corner of the civilized world.

17 black degrees and 3 copying.

For bold heavy lines.
6B-5B-4B-3B

For general writing and sketching, use
2B-B-HB-F-H

For clean fine lines.
2H-3H-4H-5H-6H

For delicate thin lines, maps, charts.
7H-8H-9H

SPECIAL 14c. OFFER

Send 14c. for three trial samples mentioning degrees. After you find how perfect VENUS Pencils are, buy them at any dealer.

American Lead Pencil Co.
217 Fifth Avenue, New York
and Clapton, London, Eng.

For Gunsmiths, Tool Makers, Experimental & Repair Work, etc.

From 9-in. to 18-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.

W. F. & J. Barnes Co.
Established 1872.
1999 Ruby Street
Rockford, Ill.

SOUTH BEND LATHES
Established in 1906 Over 19,000 South Bend Lathes in use

For the Machine and Repair Shop
LOW IN PRICE
18 in. to 24 in. swing
Straight or Gap Beds
Send for free catalog giving prices on entire line
South Bend Lathe Works
421 Madison St.,
South Bend, Ind.

THE BRIDGEPORT CHAIN CO.
Specialists in Small Wire Shapes & Flat Stampings
Bridgeport, Conn.

ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery
The VILTER MFG. CO.
899 Clinton Street *Milwaukee, Wis.*

SOLVINE BOILER PRESERVER
Warranted, without reserve, to remove boiler scale, prevent pitting and scale formation.
Pamphlet on request. Money back guarantee.
EUREKA MFG. CO. - - Jersey City, N. J.

PICK, SHOVEL AND PLUCK

Further Experiences "With the Men Who Do Things." By A. Russell Bond. 5¾x8¼ inches. Cloth, 255 pages. 110 illustrations, including 58 page-plates and colored frontispiece, $1.65, postpaid, $1.80.

A companion volume to "With the Men Who Do Things," taking the same two boys through a new series of engineering experiences. A fascinating and instructive book for boys, relating how many big things in engineering have been accomplished.

SCIENTIFIC AMERICAN PUBLISHING CO.
Woolworth Building New York City

desiring to know its position. Sometimes all the bearings reported do not intersect when diagramed on the map with black thread. Then the space enclosed by the various intersecting points designates the area in which the ship may be located.

In the immediate future every American port will be safeguarded by a system of radio compasses and control stations. Then, at any point along the coast, mariners will be enabled to check up bearings obtained in the old way, and need never fear missing the channel on a foggy night or in a rough sea.

The Aerial Police

IN southern Texas, where the pink bollworm has been trying to invade the United States from Mexico, there are cotton-free zones, declared by law as barriers against the progress of the worm. But a few misguided farmers feel that their rights have been infringed, and have accordingly developed a tendency to become outlaw farmers. Much of the country is heavily timbered. Roads are neither plentiful nor good, and it has been possible for an outlaw planter to tuck away a few acres of cotton in some nook of the woods, beyond the probability of discovery by ordinary means, though the Department of Agriculture was making diligent efforts to spot every stalk of cotton in the quarantined area.

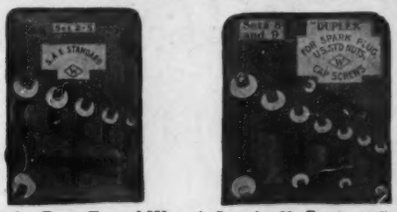
Last year the Department took advantage of an offer to try out the airplane for this scouting work. With its aid, seven outlaw cotton fields were discovered in the heavily wooded country along the Trinity River and around Galveston Bay—fields which had escaped discovery by all other means.

Similar exploration and control work has since been extended, and will doubtless be continued as long as the cotton quarantine exists. Photographic maps have been prepared of the entire district between the Brazos and Neches Rivers, and have been found of great service in keeping this area under survey and observation. Panoramic views of the country bordering the quarantine lines are made, to note the character and extent of any forests or wooded areas which might act as a natural barrier to the spread of the bollworm through flight of the moth, as well as to secure some idea of the value of aerial observations in connection with entomological work and scouting.

Flights were made at an altitude of 1,500 to 2,000 feet. At this elevation on a clear day distinct vision could be had of the country over a range of 30 miles, and cultivated fields, buildings, shell roads, railway lines, creeks, and the character of wooded areas—whether evergreen or deciduous could be easily distinguished. At the normal airplane speed of 75 miles per hour the ground moves so slowly, when observed from this height, that the observer has time to get a complete picture of the area and to make an easy distinction between cotton- and corn-fields.

After reporting in detail on the natural barriers found, the observer is enthusiastic in his belief that the airplane will tremendously facilitate all such scouting and reconnaissance work, including mapping. Photographs can be made which can be assembled into detailed maps in a very short time, as compared with ground surveys by means of motors or other conveyances. Such surveys would be particularly useful in scouting territory like that of the upper Rio Grande Valley, where cultivated areas and cotton fields, if existing, are widely separated, and the roads in many cases are practically impassable; where furthermore the distances are so great that enormous loss of time and labor would be involved in any other method of survey. So, in addition to putting before the violator of the law the threat that an eagle-eyed officer of justice may drop upon him at any moment from the sky, the new undertaking seems to be of considerable permanent scientific promise.

WILLIAMS' SUPERIOR
Drop-Forgings and Drop-Forged Tools



Superior Drop-Forged Wrench Sets for U. S., S. A. E. and A. L. A. M. Standard Nuts and Cap Screws

There has been a great demand for these Sets of Superior Drop-Forged Wrenches, not only on account of the dependability of the tools but also because of the convenient form in which they are packed. Set No. 2-S consists of five sizes of Light Service "S" wrenches, with openings milled for S. A. E. Std. Nuts and Cap Screws; Set No. 8, 7 sizes of Engineers' Wrenches milled for U. S. Std. Nuts and Cap Screws and 1 Spark Plug Wrench; "Extra Capacity" Set No. 10, 10 sizes of Engineers' Wrenches for U. S., S. A. E. and A. L. A M. Std. Nuts and Cap Screws.

J. H. Williams & Co. are known all over the world as "The Wrench People." They have been making wrenches for so many years that mechanics everywhere, when they think of wrenches, think of Williams; and Williams' Superior Wrenches have never failed them.

Write for Booklet of Superior Wrench Sets.

J. H. WILLIAMS & CO.
"The Wrench People"

Western Office and Warehouse:
28 So. Clinton Street
Chicago, Ill.

General Offices:
28 Richards Street
Brooklyn, New York

Tycos
TEMPERATURE INSTRUMENTS
Indicating Recording Controlling

Mercurial, Recording and Index Thermometers for all industrial and laboratory applications.
Electric Contact Thermometers.
Temperature, Pressure and Time Regulators.
Mercury Column Vacuum Pressure and U Gauges.
Base Metal, Rare Metal and Radiation Pyrometers.
Fery Radiation Pyrometers.
Hygrometers.
Hydrometers.
Mineral Oil Testing Instruments.
Aneroid Barometers.
Mercurial Barometers.
Recording Barometers.
Pocket Compasses
Surveying Compasses
Rain Gauges.
Anemometers.
Air Meters.
Thermographs.
Hand Levels.
Aviation Barometers.
Inclinometers.
Sphygmomanometers.
Fever Thermometers.
Urinary Glassware.
Thermometers of all kinds for home and general use.

Tycos HYDROMETERS

Trustworthy instruments for determining the relative density or weight of liquids. *Tycos* Hydrometers are made either plain (without thermometer) or in the form of Thermo-Hydrometers (hydrometer and thermometer combined in one instrument).

Let us send you the *Tycos* catalogue describing these instruments.

Taylor Instrument Companies
ROCHESTER, N. Y.

YOU would search the world for pipe happiness —and return to find it on your own door-step. In pipes there is nothing better than the higher priced W D C Pipes, which are made in America.

W D C TRADE MARK

This clean-lined thoroughbred is a W D C HAND MADE. *The genuine French briar was selected, seasoned and sterling fitted by craftsmen in our employ. The 24 shapes in this* W D C HAND MADE *quality sell in the better shops at $2 and more.*

WM. DEMUTH & CO., NEW YORK
WORLD'S LARGEST MAKERS OF FINE PIPES

Published December 2, 1918

96 Page

Catalogue of Scientific and Technical Books

Listing 2500 titles and on 500 subjects

SELECTED from more than 7,000 Books still in print. This catalogue is the latest and best list of technical and scientific literature which can be secured. Conditions in the publishing business are most severe and it is with difficulty that many books can be obtained. For this reason this timely catalogue of books which can be had will be particularly welcome.

Write to-day for your copy. Sent free on application.

SCIENTIFIC AMERICAN PUBLISHING CO.
233 Broadway, Woolworth Bldg. New York, N. Y.

HOTEL MARTINIQUE
BROADWAY, 32d & 33d STS.
NEW YORK

"The House of Taylor"

One Block from Penna. Station. Baggage Transferred Free

Equally Convenient for Amusements, Shopping or Business

Direct Entrance to B'way Subway and Hudson Tubes

600 ROOMS
400 BATHS

Rates:—From $2 Per Day

A SPECIALTY
155 PLEASANT ROOMS With Private Bath

$3 Per Day

The Martinique Restaurants Are Well Known for Good Food and Reasonable Prices

IN THE HEART OF THINGS

NEW BOOKS, ETC.

ESSENTIALS OF DRAFTING. By Carl L. Svensen, B.S. New York: D. Van Nostrand Company, 1918. 8vo.; 184 pp.; illustrated. Price, $1.50 net.

A well-planned text for apprentice, trade and evening technical schools appears under the title "Essentials of Drafting." The limited time and the special needs of the night student are fully taken into account, and he is first taught to represent simple parts in strict conformity to the laws of projection. In more complicated work, the importance of knowing what lines to draw and what to leave out is emphasized; apparent violations of orthographic projection, and other expedients for making involved relationships readily intelligible, are closely explained. Utility has been the touchstone; the exposition runs well into elementary machine design, and there are brief treatments of materials and stresses and the estimation of weights.

ELECTRIC MOTORS AND CONTROL SYSTEMS. A Treatise on Electric Traction Motors and Their Control. By A. T. Dover, A.M.I.E.E. New York: Isaac Pitman and Sons, 1918. 8vo.; 372 pp.; 315 illustrations. Price, $6.

As an amplification of portions of the work, "Electric Traction," this treatise will be welcomed by those requiring a broader treatment of the principles and special features of this application of electricity to traction. It meets the needs of the advanced student and the engineer, and is representative of the best modern practice. Among notable extensions of, or additions to, the original material, will be marked discussions on special types of single-phase motors including theory and vector diagrams of the doubly-fed motor; polyphase motors, including pole-changing windings; double series-parallel control; the calculation of rheostat sections; and many examples from examination papers. The work is of British origin.

A HANDBOOK ON PIPING. By Carl L. Svensen, B.S. New York: D. Van Nostrand Company, 1918. 8vo.; 359 pp.; 359 illustrations, 8 folding plates. Price, $4 net.

Engineers will appreciate the collection of such comprehensive information on piping, conveniently arranged in one substantial volume. Thread, fittings, joints, and valves are treated in separate chapters. All systems of steam piping are included, with special consideration of heating systems, water and hydraulic piping, compressed air, gas, and oil piping, insulation, drawings, and specifications. There is a chapter on erection and workmanship, and an appendix consisting of eight folding plates showing plans and elevation of main steam lines, auxiliary exhaust lines, and boiler feed lines. The tables and formulae are excellent in variety and extent, and a useful bibliography rounds out a work of distinct service to the student and engineer.

STORING. Its Economic Aspects and Proper Methods. By H. B. Twyford. New York: D. Van Nostrand Company, 1918. 8vo.; 200 pp.; illustrations and forms. Price, $3 net.

The problems of storage are continually coming to the fore; the way in which these are met not infrequently means a fortune lost or gained. More scientific solutions are constantly being sought with a view to cutting costs and remedying irregularites in supply and demand. This new work studies from a practical point of view the economic side of the question, deals with specifications and standardization, plans the location and equipment of the storeroom, illustrates the necessary appliances, considers the manual operations, the clerical work, and the stores department, and treats of the reception of material, its inspection and placing in the storeroom, and its eventual delivery. The best practice of the most prominent firms is embodied in the work, and the business man and his storekeeper will find in the work a mine of suggestion directly applicable to the most varying conditions.

THOMAS' REGISTER OF AMERICAN MANUFACTURERS AND FIRST HANDS IN ALL LINES. New York: Thomas Publishing Company, 1918. 4to.; 4,200 pp. Price, $15.

The worth of a publication of this kind is gaged by its comprehensiveness, its accuracy, and the accessibility of its varied contents. The size and weight of the Thomas' Register mark it as the largest classified reference book in the world; the most exacting tests prove the completeness of the information, and the degree of accuracy attained is very high. The classified section constitutes the main division of the volume in which, under the various articles of manufacture, alphabetically arranged, appear the States, also alphabetically arranged; under these come the firm names of manufacturers, usually with the street address as well as the town, followed by the estimated capital. An appendix contains representative banks, boards of trade and similar commercial organizations, and trade papers. Another list enables the user to locate the head office and often the branch offices of any important firm, with the names of individual officers and other data. This section is of inestimable value for mailing lists for it avoids the duplication of names—a common annoyance—and facilitates accurate addressing. Another unique feature is the indexed list of leading trade names: knowing the trade name or brand, the place to buy any article thus designated is readily found. The use of different-colored paper for the different sections adds greatly to the ease of reference. The sterling service offered by this work to buyers and sellers, and the care and ingenuity that has gone to its make-up, cannot be overestimated. Its scope and accuracy of detail give it a commanding position in the business world.

ARCHITECTURE AND DEMOCRACY. By Claude Bragdon, F.A.I.A. New York: Alfred A. Knopf, 1918. 8vo.; 213 pp.; illustrated. Price, $2 net.

These papers begin with the significant studies of our solid modern architecture, before, during, and after the war, as an expression of individual and national thought; they pass on to ornament derived from mathematics, which by easy stages leads the author into his favorite subject of the fourth dimension, and thence to symbols and sacraments. What the book lacks in unity of theme it makes up for by a unity of point of view. Mr. Bragdon has the provocative faculty in its highest development. The reader may personally prefer the Woolworth Building to the Prudential Building in Buffalo, and the huge geometric patterns of the author's "imaginative compositions" may but emphasize human insignificance: yet a beneficial stimulation and a broadening of the prospect is sensed in almost every paragraph.

THE LUNCH ROOM. By Paul Richards. Chicago: The Hotel Monthly. 8vo.; 238 pp.; illustrated. Price, $2.

Lunch room operation in all its detail is set forth here by an authority, from the best practice in arrangement and equipment to management, accounting, sales, bills of fare, and receipts. The book will be of the greatest assistance toward making the lunch room more cleanly, attractive, convenient and economical, the food more appetizing, and the business more profitable. The lavish illustrations include floor plans, modern furniture, machines and utensils, bookkeeping and menu forms, and typical restaurants and tea rooms.

RAILWAY STATISTICS OF THE UNITED STATES OF AMERICA. For the Year Ended December 31, 1917. Prepared by Slason Thompson. Chicago: Bureau of Railway News and Statistics. 8vo.; 128 pp.; maps.

The fifteenth annual issue of this able compilation of statistics, comparison and comment shows that our railways were "at the apex of their efficiency and the nadir of their credit" when taken over by the Government. Progress is shown by decades, revenues and expenses are itemized and compared with those for 1916, mileage, construction, equipment, and all other headings under which the problems of railway administration fall are tabulated and discussed, foreign statistics are given, and the growth of the world's railways is tabulated.

PITMAN'S PROGRESSIVE FRENCH GRAMMAR. By Frank A. Hedgcock, M.A. New York and London: Isaac Pitman and Sons, 1918. Part I. 12mo.; 326 pp. Price, $1.45.

The author believes that "knowing a foreign langiage" should mean, first and foremost, the ability to speak, read, and write it in its everyday applications, and that a literary knowledge of the language should come later. He is suspicious of the passive method in education, and his leaning toward the practical is seen in this new textbook, which will thoroughly meet the approval of those holding similar views. It is not a "direct method" manual, but furthers the same end by the liberal use of question and answer; and it keeps to the fore the main operations of language—to make statements, to ask questions, and to give commands.

THE STARRETT BOOK FOR MACHINISTS' APPRENTICES. Vol. I of the Starrett Books. By Howard P. Fairchild and Carl S. Dow, S. B. Athol, Mass.: The L. S. Starrett Company, 1918. 12mo.; 184 pp.; illustrated. Price, 50 cents.

Descriptions of measuring tools and suggestions as to using them are followed by hints on chipping, filing, polishing and other operations, by tables for ready reference and by brief papers on drilling, lathes and lathe work, toolmaking, etc. The apprentice will find sound instruction that will enable him to quickly gain skill in laying out work.

Copyright 1919, by The Goodyear Tire & Rubber Co.

What Came of a Letter—and a G.T.M. Call

$123.83 has been saved in seven months on the draft-fan drive of the Darlington Clay Products Company. The best belt they had ever had on that drive gave service at a cost of $25.32 per month. The Goodyear Belt recommended by a G. T. M.—Goodyear Technical Man—has cost only $7.63 per month. In the last seven months, therefore, the G. T. M.'s service has saved $123.83—and will save more in the months to come. Even more important to Mr. Tefft, the manager, there is no more trouble on that drive. A letter of inquiry written to Akron by Mr. Tefft was the first cause of these gratifying results.

In it he described his draft-fan drive and the trouble and expense it was causing. He wrote that the belt ran between the brick walls of a pit—coming to within an inch of walls often at a temperature of 300 degrees. He stated that sulphur fumes—SO_2—went over the belt; and that the nightman in oiling the fan bearings generally let oil drip on the belt. He added that the best belt he had been able to get gave about 8 months' service at a cost of $202.61—$25.32 per month—and lots of trouble and repairs thrown in for good measure.

We sent a G.T.M.—our Mr. Hunter—to look the drive over. He decided that *as it stood* it would always be expensive and troublesome—even if Goodyear Belts specified by a G.T.M. were used. So he put up an oil guard at the right place—had a hole cut in the wall to provide a draft to carry off the heat—and after careful measurements specified an 8-inch 5-ply Goodyear Blue Streak made endless. It cost $53.41 and was applied June 5th, 1918.

On January 5th, 1919, at the time this advertisement went to press the belt was still running. It had given seven months' service at a cost of $7.63 per month—had never required repairs or other attention, and to Mr. Tefft looked good for months more of perfect service. It does better work than the former belt which cost at least $17.69 more per month of service. Mr. Tefft attributes the consequent saving of $123.83 in seven months, and the relief from trouble, to the G. T. M.; he has had a G. T. M. analyze and prescribe a belt for every drive in the plant, and has already ordered the prescribed Goodyear equipment for five drives.

If you have a belt-devouring drive that is eating too many dollars, ask a G.T. M. to call. He'll do it without charge when he's in your vicinity. There are many of them—all trained in the Goodyear Technical School—all with experience in plants similar to yours—all selling belts to meet conditions and not as a hardware man sells nails. We are able to give the G.T. M.'s services free only because the savings they effect for purchasers are so considerable that a gratifying volume of business from the plants analyzed is sure to result within a year or two. The G. T. M.'s analysis and prescriptions do not obligate you in any way.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

BELTING · PACKING · HOSE · VALVES

GOODYEAR

AKRON

RECONSTRUCTION

Big business calls for high speed during reconstruction. New buildings go up almost over night.

Mack Trucks are essential hauling units wherever speedy construction is demanded. They keep necessary material arriving well ahead of time—construction work steadily going on. Their strong, dependable bodies bear heavyweight loads, their powerful engines furnish ample power to transport them quickly.

Mack flexibility and easy control permit operation over broken, obstructed ground with safety and dispatch.

Made in 1, 1½, 2, 3½, 5½, and 7½ tons.

Send for catalog and specifications.

INTERNATIONAL MOTOR COMPANY
NEW YORK

"PERFORMANCE COUNTS"